

REPAIR MANUAL

AXLES AND STEERING

ENGINE

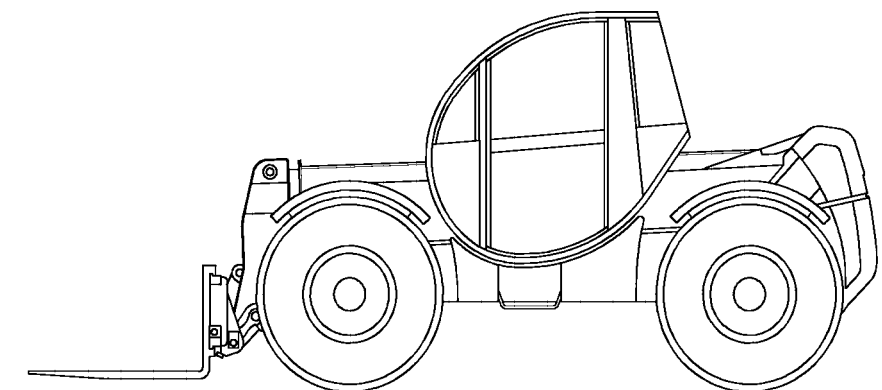
TRANSMISSION

BOOM

CHASSIS

TECHNICAL DATA

CLAAS



LH70010

CLAAS TARGO K50 K60 K70

The machines in this handbook are designed essentially for agricultural and associated applications. This is their intended use.

Any modifications made to the machine without prior written approval from CLAAS or if the machine is used in any way contrary to the intended use or if the machine is not properly driven or maintained then the Company will not accept any liability whatsoever for any damage or injury (whether direct or consequential).

The method of operation and maintenance specified in this handbook should be strictly adhered to.

For your parts requirements, it is essential that only genuine CLAAS parts are fitted. Any resultant damage from non-genuine parts will invalidate your machine warranty.

CLAAS operates a policy of continuous improvement to its products and reserve the right to change specifications and equipment without notice. Therefore some information within this handbook may differ from your machine.

This manual is designed to service machines:

**from Serial No. 51200011
up to Serial No. 51200727.**

**from Serial No. K5D00100
from Serial No. K6D00100
from Serial No. K7D00100**

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General

The contents of this Repair Manual, although correct at the time of publication, may be subject to alteration by the manufacturer without notice.

This manual assumes that maintenance personnel have a sound knowledge of workshop practices and safety procedures associated with the repairs of this type of machine. This manual is designed to assist with the more specialised information required for removal and strip-down of major components.

It is recommended that the relevant part of this Repair Manual is studied carefully before proceeding with any maintenance.

Machine identification

To make sure that the correct parts are obtained, always quote the machine Serial Number when ordering parts.

Health and Safety

To prevent injury to personnel and damage to equipment and machinery, care must be taken to operate in a safe manner. Read the Safety Warnings that follow and always work in a safe manner and obey the relevant Warnings.

Throughout this manual and on the machine there are safety notes. Each note starts with a single word. The meaning of these single words is as follows:

WARNING *Identifies a hazard exists. If proper precautions are not taken, it is highly probable that the operator (or others) could be killed or seriously injured.*


















CAUTION *Identifies a reminder of safety practices. Failure to observe these safety practices could result in injury to the operator (or others) or damage to the machine.*



In general these notes are used to indicate that the procedures being described in the manual must be followed to avoid serious injury or death to yourself or others. The notes are also used to protect the machine from unsafe maintenance practices.

SAFETY WARNINGS

- WARNING**  Always wear correct fitting protective clothing. Loose or baggy clothing can be extremely dangerous when operating or maintaining a machine.
- WARNING**  Where possible, only work on or close to engines or machinery when they are stopped. If this is not practical, remember to keep tools, test equipment and all parts of your body well away from moving parts.
- WARNING**  Avoid contact with exhaust pipes and exhaust manifolds when the engine is running; these can be very hot.
- WARNING**  Many liquids used on this machine are harmful if taken internally or splashed into the eyes. In the event of accidentally swallowing oil, diesel fuel, anti-freeze, battery acid etc., **DO NOT** induce vomiting, but **OBTAIN QUALIFIED MEDICAL ASSISTANCE IMMEDIATELY**.
- WARNING**  Always obtain advice before mixing oils; some are incompatible.
- WARNING**  Never run an engine in an enclosed space unless an exhaust extraction system is used.
- WARNING**  Always disconnect battery cables before working on the electrical system to prevent injury caused by electric shock.
- WARNING**  When it is necessary to work on the electrical system with power on, for fault diagnosis, always have a safety man in attendance
- WARNING**  Any dust found on the machine or produced during work on the machine should be removed by extraction, not by blowing. Dust waste should be dampened, placed in a sealed container and marked for safe disposal.
- WARNING**  Always dump pressure from the hydraulic system before carrying out any maintenance or adjustment (**refer to Hydraulic Repair Manual**).
- WARNING**  Never leave the machine unattended with pressure in the system.
- WARNING**  Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. If hydraulic fluid penetrates your skin **OBTAIN QUALIFIED MEDICAL ASSISTANCE IMMEDIATELY**.
- WARNING**  Never allow unqualified personnel to attempt to remove or replace any part of the machine.
- WARNING**  Always use the correct lifting equipment to remove large or heavy components.
- WARNING**  Never attempt to lift or hold up the machine using the lash-down points.

SECTION 1

AXLES AND STEERING

Axles

Description

The front and rear axles are both double reduction by bevel set and planetary hub reduction gears, both have limited slip differentials. The front axle incorporates a parking brake.

Steering is available to both axles, depending on the steering mode selected. The axle hubs are steered by the operation of a double acting hydraulic cylinder attached to the axle.

Front axle

Removal

1. Park the machine on firm level ground and set the wheels straight ahead, in line with the chassis. Fit chocks to the front and rear of the rear wheels.
2. Raise the boom and fit the boom safety stop.
3. Stop the engine and apply the parking brake.
4. Refer to page 1.53 and dump hydraulic pressure from the brake systems, then disconnect the battery.

CAUTION



Support the drive shaft clear of the axle to make sure it is not damaged during axle removal.

5. Disconnect the drive shaft from the axle flange and support clear of axle.
6. Disconnect the inductive magnetic steering sensor electrical lead.
7. Slacken front axle wheel nuts.
8. Support the chassis at a sufficient height to allow the wheels to be removed.
9. Support axle with a fork-lift or trolley jacks.
10. Remove front wheels.
11. Disconnect brake pipes (2) and (3) from left and right brake unit, fit blanks to open pipes and brake unit connections.

12. Disconnect steering pipes (1) from steering cylinder, fit blanks to open pipes and steering cylinder connections.

WARNING



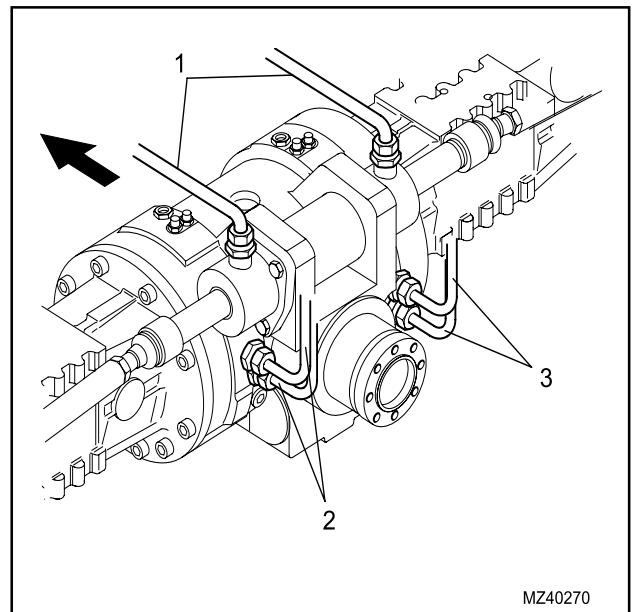
Secure the axle to the fork-lift/trolley jacks to prevent axle tipping on removal.

The axle weighs 443 kg, take care when removing and transporting.

13. Remove the eight attachment bolts/nuts securing axle to chassis (four each side) and remove support plates.

14. Lower axle on fork-lift/trolley jacks.

15. Move axle clear of machine and place on a suitable support.



1. Steering pipes
2. Left brake pipes
3. Right brake pipes

Installation

1. Installation is the reverse of the removal procedure.
2. Torque load components as follows:

Axle to chassis nuts	640 Nm (472 lbf ft.)
Drive shaft bolts	70-85 Nm (52-63 lbf ft.)
Wheel nuts	300 Nm (221 lbf ft.).
3. Check axle and wheel hub oil levels are correct.
4. When the axle has been dismantled and reassembled, refer to the Axle Assembly section and test the differential operation.
5. Refer to Page 1.52 and bleed then check brake function.
6. Start engine, make sure front wheel steering is selected and operate steering through full range several times to bleed air from steering system.
7. Test machine operation.

REAR AXLE

Removal

1. Park the machine on firm level ground and set the wheels straight ahead, in line with the chassis. Fit chocks to the front and rear of the rear wheels.

2. Raise the boom and fit the boom safety stop.

3. Stop the engine and apply the parking brake.

4. Refer to page 1.53 and dump hydraulic pressure from the brake systems, then disconnect the battery.

CAUTION



Support the drive shaft clear of the axle to make sure it is not damaged during axle removal.

5. Disconnect the drive shaft from the axle flange and support clear of axle.

6. Disconnect the load sensor electrical lead.

7. Disconnect the inductive magnetic steering sensor electrical lead.

8. Slacken rear axle wheel nuts.

9. Support the chassis at a sufficient height to allow the wheels to be removed.

10. Support axle with a fork-lift or trolley jacks.

11. Remove the bolts attaching the axle front support to the chassis.

12. Remove the bolts attaching the axle rear support to the chassis.

13. Remove rear wheels.

14. Disconnect brake pipes (2) and (3) from left and right brake units, fit blanks to open pipes and brake unit connections.

15. Disconnect steering pipes (1) from steering cylinder, fit blanks to open pipes and steering cylinder connections.

WARNING

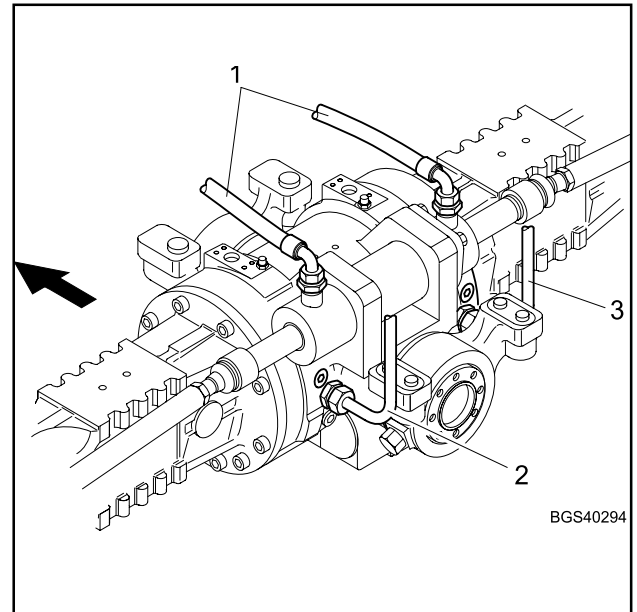


Secure the axle to the fork-lift/trolley jacks to prevent axle tipping on removal.

The axle weighs 443 kg, take care when removing and transporting.

16. Lower axle on fork-lift/trolley jacks.

17. Move axle clear of machine and place on a suitable support.



1. Steering pipes

2. Right brake pipes

3. Left brake pipes

Installation

1. Installation is the reverse of the removal procedure.

2. Torque load components as follows:

Axle to chassis nuts	640 Nm (472 lbf ft.)
Drive shaft bolts	70-85 Nm (52-63 lbf ft.)
Wheel nuts	300 Nm (221 lbf ft.)
Axle support bolts	370 Nm (273 lbf ft.)

3. Check axle and wheel hub oil levels are correct.

4. When the axle has been dismantled and reassembled, refer to the Axle Assembly section and test the differential operation.

5. Refer to Page 1.52 and bleed then check brake function.

6. Start engine, make sure rear wheel steering is selected and operate steering through full range several times to bleed air from steering system.

7. Test machine operation.

Servicing

Dismantling and assembly (General)

WARNING *Dispose of used axle oil in accordance with local regulations.*



NOTES:

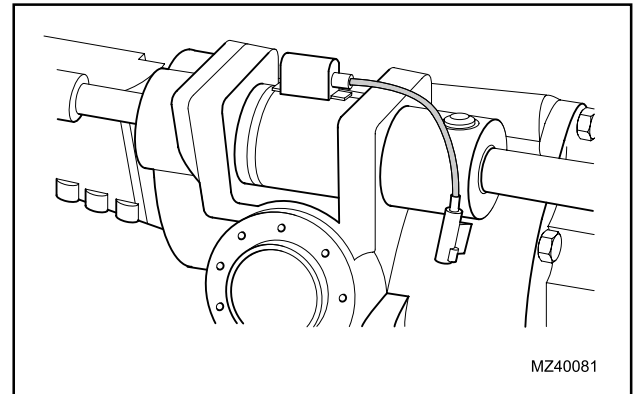
- (1) **Sealing Compound.** Ensure both surfaces to be sealed are clean, dry and free from grease.
- (2) **O-ring seals.** Lubricate seals before fitting to prevent twisting when inserting the shaft
- (3) **Bearings.** It is recommended (but not mandatory) that bearings are heated to 80°C - 90°C before fitting to shaft, or cooling with dry ice before inserting them into an outer housing.
- (4) **Shims.** Measure shims before use, do not rely on measurement marked on shim.
- (5) **Torque loading.** Torque load all components to the recommended figure.
- (6) **Oil seals.** To assist with the correct installation of oil seals carry out the following:
 - Ensure the shaft is clean and not damaged
 - Assemble with lip side towards the oil side
 - Lubricate seal with oil and fill $\frac{3}{4}$ of seal cavity with grease
 - Use special tools to install seals, where available. Do not hammer directly on the seal
 - Do not damage seals while assembling the shaft.
- (7) **Special tools.** Use the special tools to dismantle and assemble the axle.

Dismantling

Steering cylinder

Removal

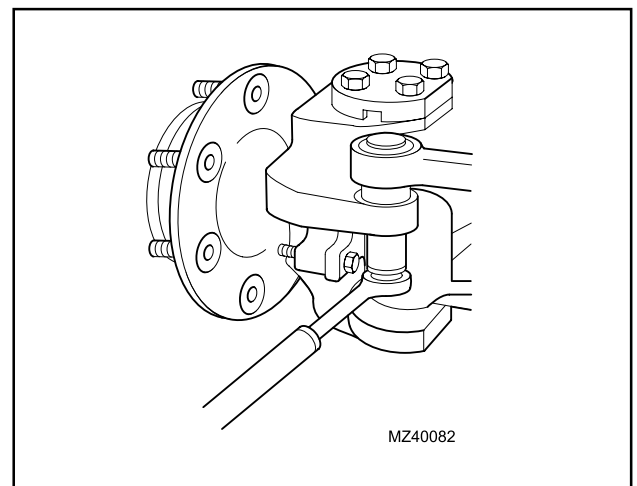
1. Remove the inductive magnetic steering sensor, by loosening the locking clamp screws.



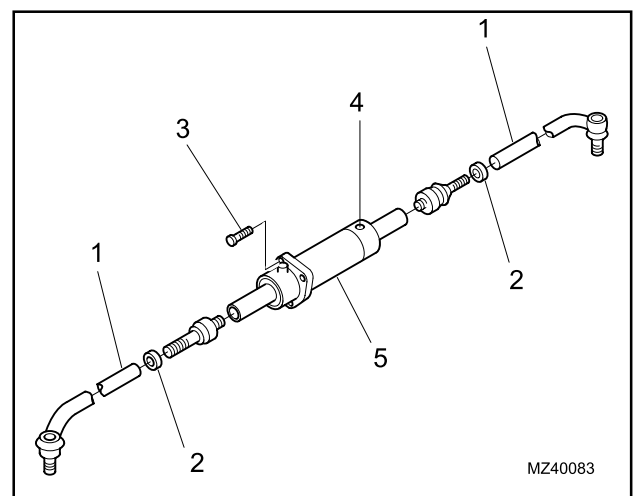
2. Loosen the track rod end nut until it covers end of threaded pin.

3. Use a suitable tool and break the track rod joint.

NOTE: This may damage the nut, use a new nut on assembly.



4. Remove both the track rods (1) by loosening the lock nut (2) and unscrewing track rod from ball joint. Remove the three cylinder attachment bolts (3) and hydraulic adapter (4) from steering cylinder (5). Remove cylinder from axle mounting brackets, if necessary use a rubber hammer.



Cylinder overhaul

Refer to Hydraulic Manual for cylinder Dismantling and Assembly.

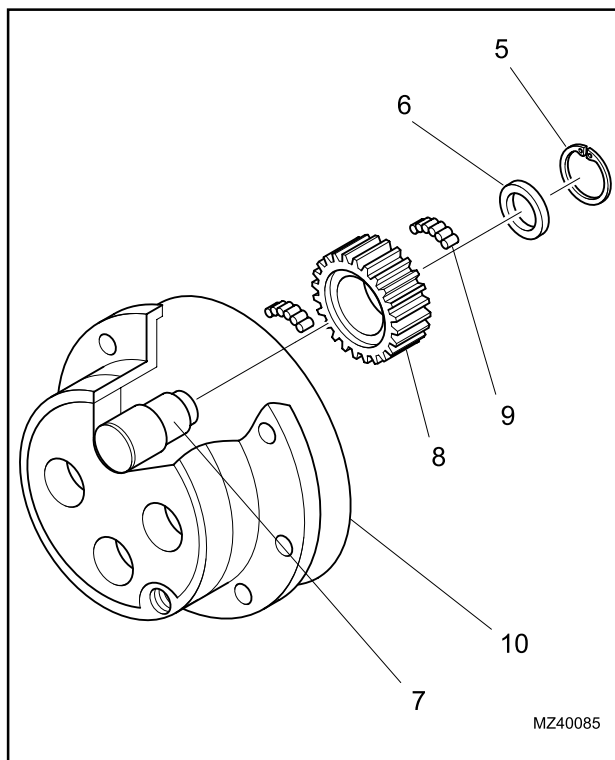
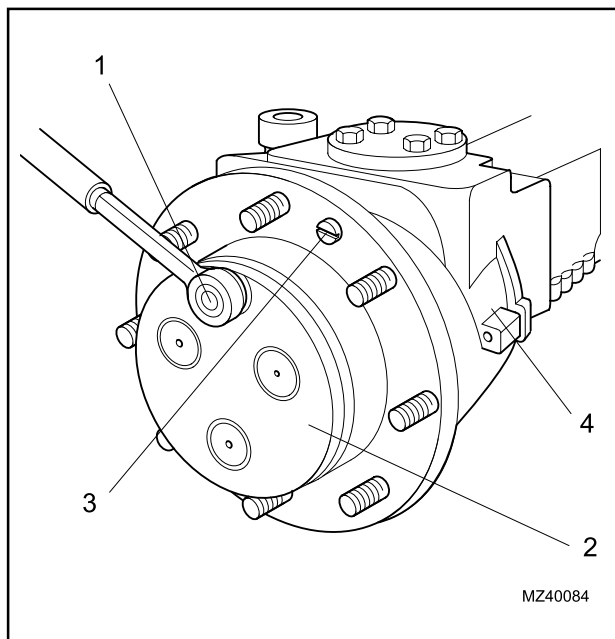
1. Track rod
2. Nut
3. Bolt
4. Hydraulic adapter
5. Steering cylinder

Epicyclic reduction gear

NOTE: This procedure is for the left or right hand epicyclic reduction gear.

1. Position drain plug (1) at highest position and loosen, to dissipate any pressure in axle.
2. Rotate planetary carrier (2) until drain plug is at lowest position, remove drain plug and drain oil into a suitable container.
3. Remove the planetary carrier retaining screws (3) and remove carrier from wheel hub (4).
4. Position the planetary carrier on a clean workbench and check components for wear and condition.
5. Remove O-ring (10) and check condition.
6. If necessary, replace components in planetary carrier as follows:
7. Remove the lock rings (5) and washers (6) from pins (7).
8. Remove planetary gears (8) from pins.
9. Remove the needle roller bearings (9) from the gears.

NOTE: When a new planetary gear is fitted, it is recommended that new needle roller bearings are fitted.

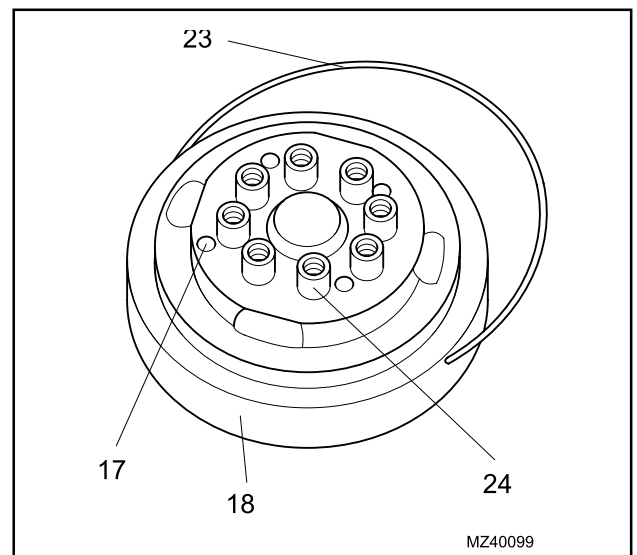
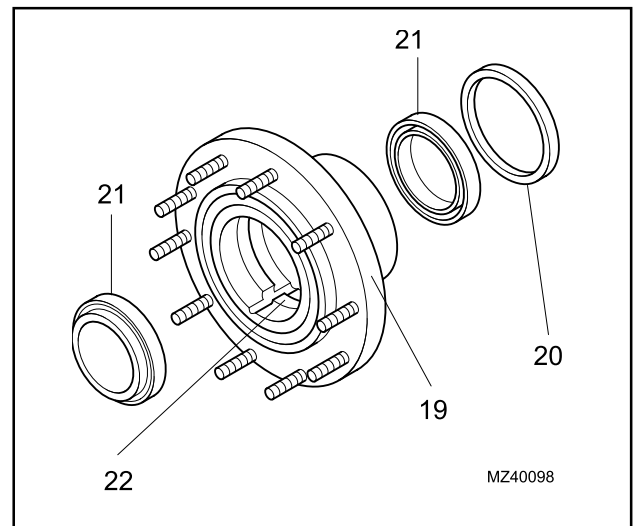
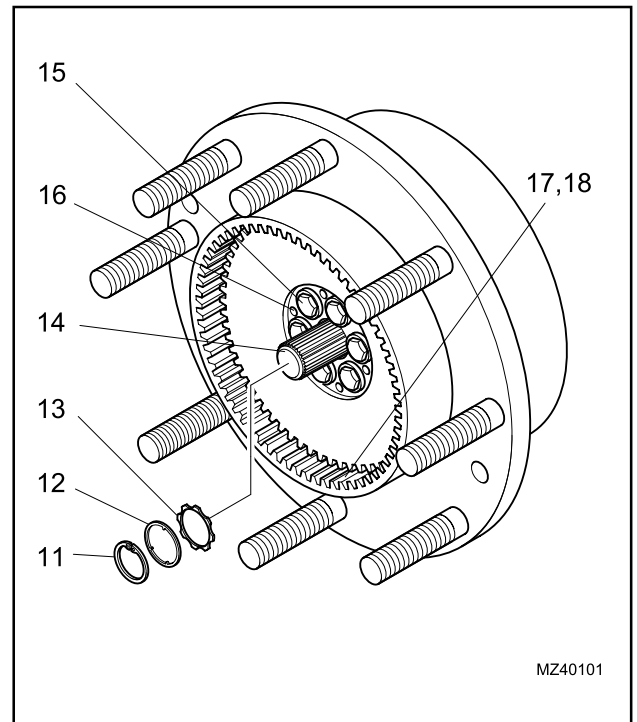


1. Drain plug
2. Planetary carrier
3. Retaining screws
4. Wheel hub
5. Lock ring
6. Washer
7. Pin
8. Planetary gear
9. Needle roller bearings
10. O-ring

Wheel hub

NOTE: This procedure is for the left or right hand wheel hub.

1. Remove the circlip (11) and washers (12 & 13) from the U/J shaft (14).
2. Remove the hub lock ring gear attachment bolts (15).
3. Fit at least two of the hub lock ring gear attachment bolts (15) into the threaded extraction holes (16) and tighten evenly to push the carrier off the hub.
4. Remove the hub lock ring gear (17) and the epicyclic ring gear (18) from the wheel hub (19).
5. Remove the wheel hub from the axle, careful use of hammers and levers may be necessary.
6. Position the wheel hub on a suitable workbench and remove the bearing seal (20) with a lever.
7. Remove the inner and outer bearings cups (21) from the housing using a hammer and drift.
8. Remove the bearing cone (22) from the swivel housing side of the hub using a suitable extractor.
9. Remove the lock ring (23) securing the hub lock ring gear (17) to the epicyclic ring gear (18) and separate the units.
10. Examine the hub lock ring gear (17) and the epicyclic ring gear (18) for wear. If necessary, remove the centring bushes (24) of the hub lock ring gear with a hammer and special tool Part No, CA715027.



11. Circlip
12. Washer
13. Washer
14. U/J shaft
15. Bolt
16. Threaded hole
17. Hub lock ring gear
18. Epicyclic gear
19. Hub
20. Bearing seal
21. Bearing cups
22. Bearing cone
23. Lock ring
24. Bush

WARNING *The swivel housing is heavy and must be supported with suitable equipment before the king pins are removed.*



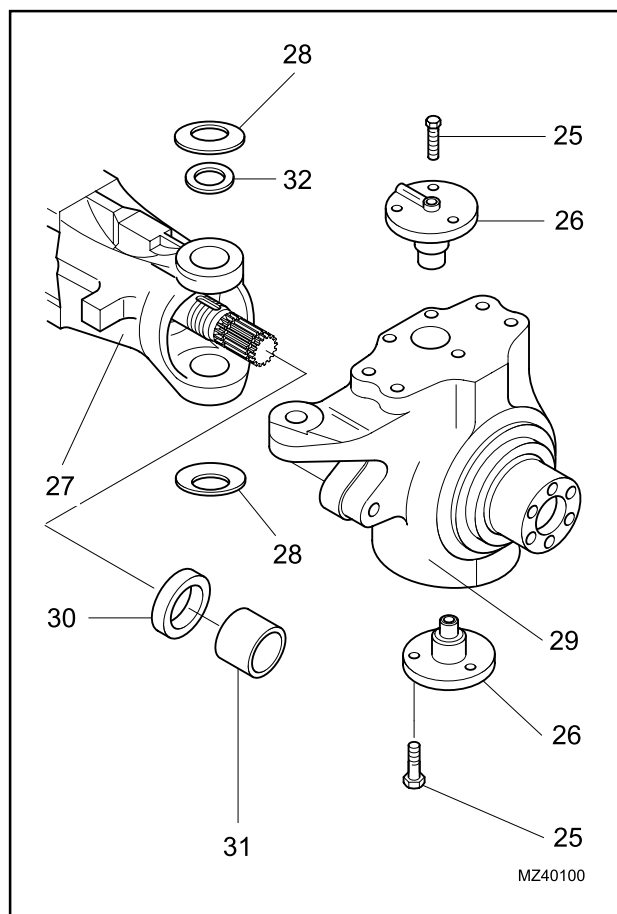
11. Remove the bolts (25) securing the upper king pin (26) to the axle beam (27), remove the king pin, the belleville washers (28) and shim (32).

12. Remove the bolts (25) securing the lower king pin (26) to the axle beam (27), remove the king pin and the belleville washers (28).

13. Remove the swivel housing (29) from the axle beam and position on a suitable workbench.

14. Remove the sealing ring (30) from the swivel housing.

15. Invert the housing and remove the bush (31) using a hammer and drift.



- 25. Bolt
- 26. King pin
- 27. Axle beam
- 28. Belleville washer
- 29. Swivel housing
- 30. Sealing ring
- 31. Bush
- 32. Shim

Axle beam trumpet and brake group

NOTE: This procedure is for the left or right hand axle beam trumpet and brake group.

1. Remove the drive shaft (1) from the axle beam (2).

NOTE: The removal procedure for sealing ring (3) will destroy the sealing ring.

2. Remove the sealing ring (3) with a lever and examine the bush (4) for wear.

NOTE: Only remove bush (4) if worn or damaged, the removal procedure will destroy the bush.

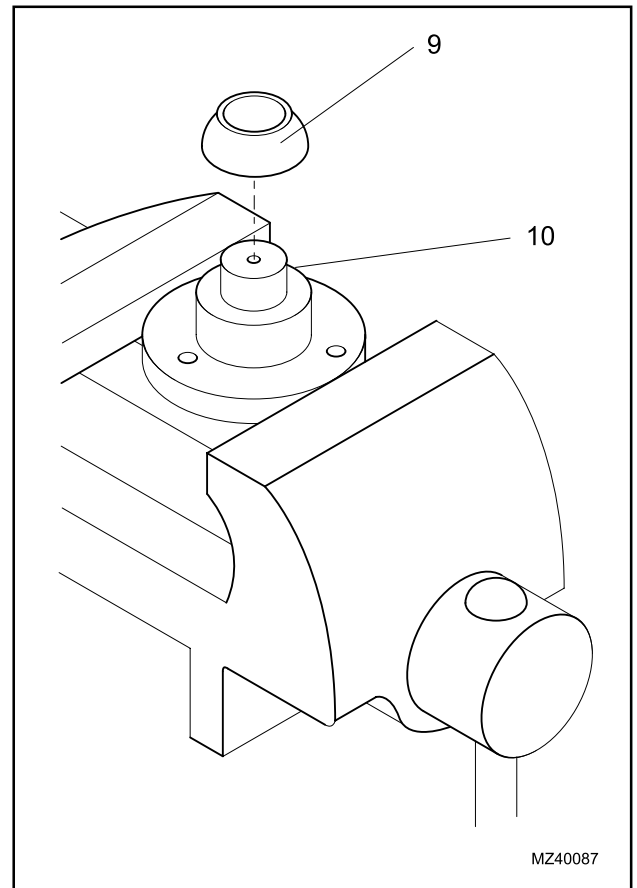
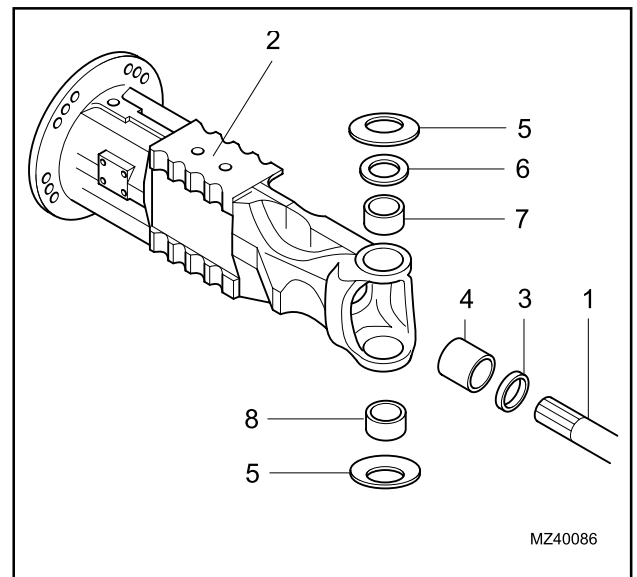
3. Remove bush (4), if worn or damaged, by carefully cutting the bush with a chisel before extraction.

NOTE: The belleville washers (5) and shim (6) may have been removed during the wheel hub removal procedure.

4. Remove the belleville washers (5) from the upper and lower beam housing and the shim (6) from the upper housing.

5. Using a suitable extractor, remove the upper and lower bushes (7 & 8) from the axle beam (2).

6. Remove bush (9) from upper and lower king pins (10).



1. Drive shaft
2. Axle beam
3. Sealing ring
4. Bush
5. Belleville washer
6. Shim
7. Bush
8. Bush
9. Bush
10. King pin

7. Put identification marks on the differential (11), left/right brake packs (12) and left/right axle beams (2) to aid assembly.

WARNING

The axle beams weighs 80 kg. Take care when removing axle beams from differential and use suitable lifting gear.

8. Position the axle on a suitable workbench and attach lifting gear to the axle beam being removed.

WARNING

The brake discs and fixed discs are loose when the axle beam is removed. Take care not to damage brake discs and fixed discs.

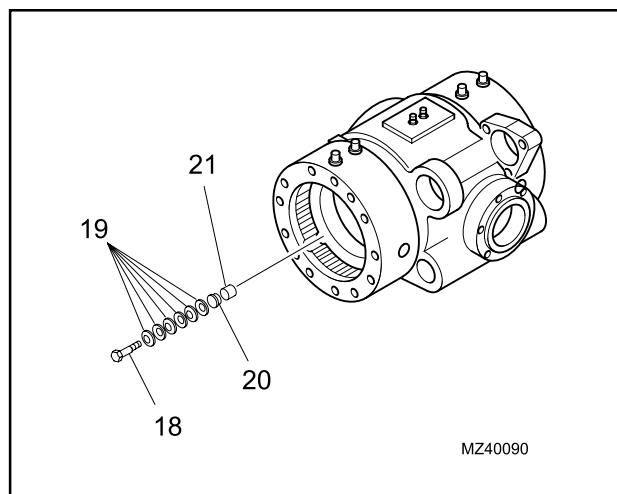
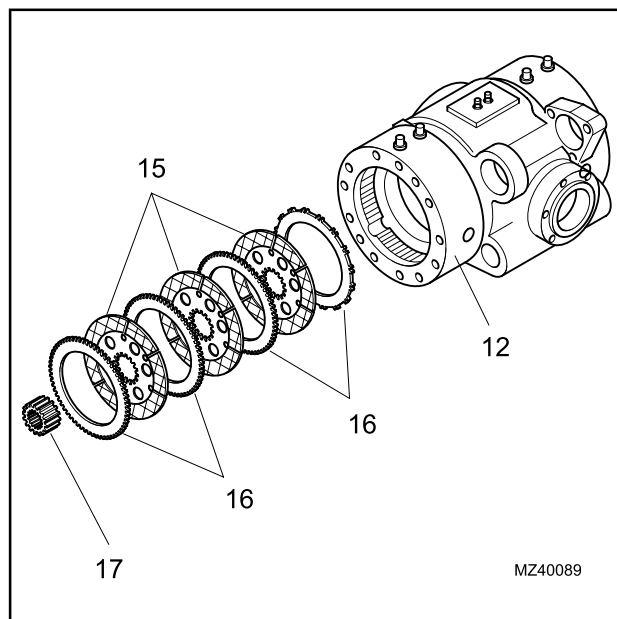
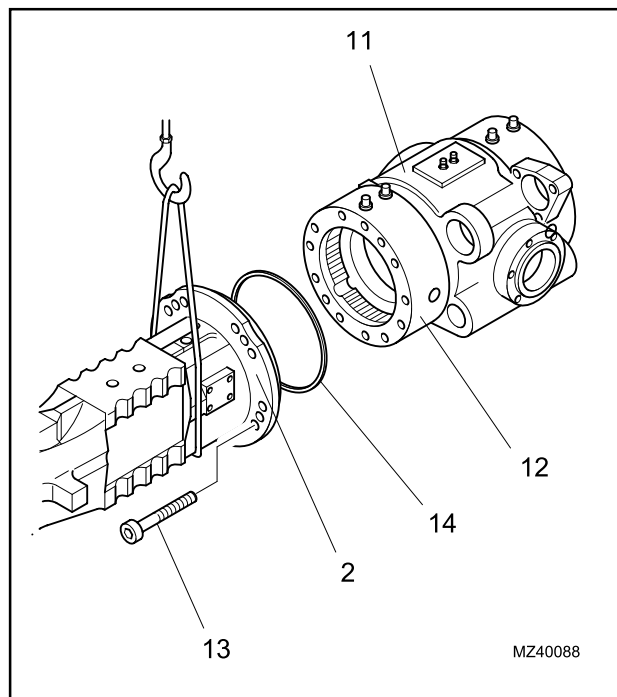
9. Remove the axle beam retaining screws (13) and nut from the lower stud. Remove axle beam (2) from brake pack/differential assembly.

10. Remove O-ring (14) from axle beam.


NOTE: Record the position of the sleeve (17) to aid assembly.

11. Remove the brake discs (15), fixed discs (16) and sleeve (17) from the brake pack (12).

12. Remove the two self-adjust bolts (18), Belleville washers (19), bush (20) and Belleville washer (21) from the brake housing.




- 11. Differential
- 12. Brake pack
- 13. Screw
- 14. O-ring
- 15. Brake disc
- 16. Fixed disc
- 17. Sleeve
- 18. Bolt
- 19. Belleville washers
- 20. Bush
- 21. Belleville washer

WARNING  Hydraulic or air pressure can be used to remove the brake piston. Only use the minimum pressure necessary to move piston.


13. Attach a suitable hydraulic or air supply to the brake inlet connection (22) on the brake pack (12). Apply the minimum pressure to move the piston.

14. Remove piston (23) and O-rings (24).

15. Remove O-rings from piston and inspect for wear. Remove the three self-adjust split bushings (25) from the piston bores.

CAUTION  Unscrew the parking brake adjuster screws one turn at a time alternately to avoid damage to the brake.

16. Remove the three parking brake adjuster screws (26) and O-rings.

WARNING  The next step separates the brake pack from the differential unit. Make sure the brake pack is attached to suitable lifting equipment before removal.

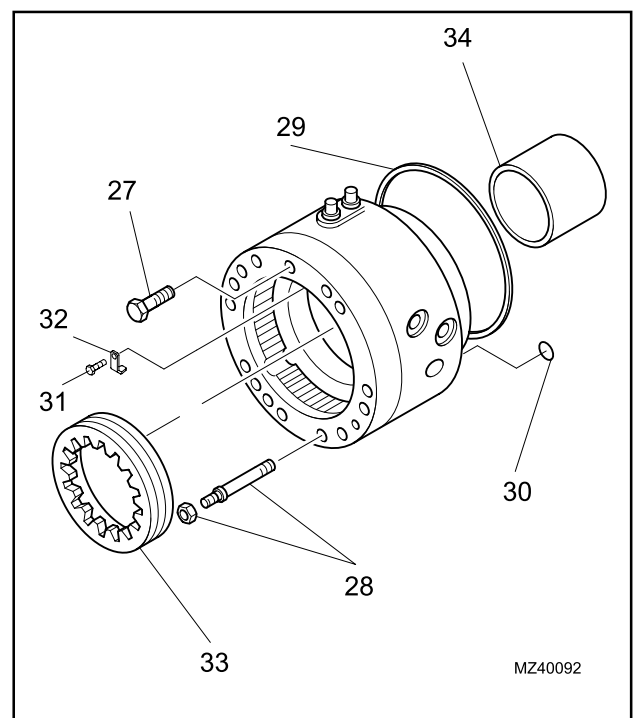
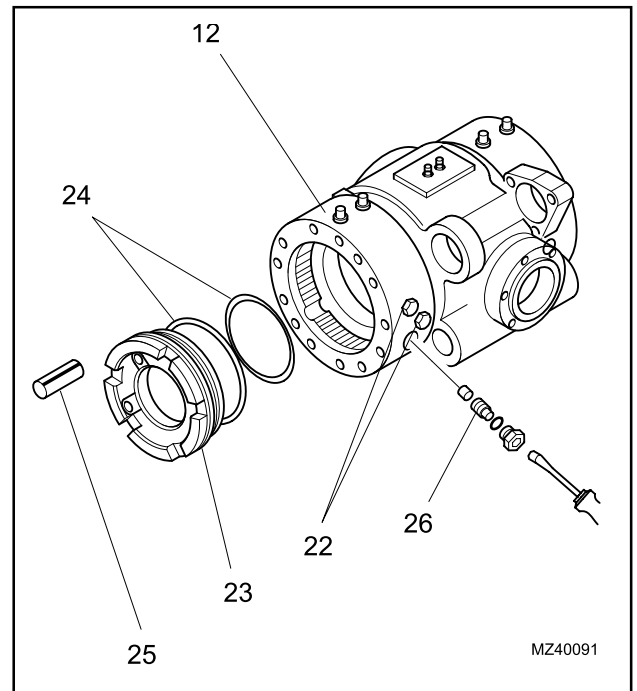
17. Connect the brake pack (12) to suitable lifting equipment .

18. Remove the upper securing screw (27) and the lower stud bolt (28). Remove the brake pack from the differential unit.

19. Remove the housing O-ring (29) and the oil pipe O-ring (30).

20. Remove the bolt (31) and lock nut retainer (32).

21. Remove the lock nut (33) from the brake flange, using special tool Part No, CA119030.



- 22. Brake inlet connection
- 23. Piston
- 24. O-ring
- 25. Bushing
- 26. Adjuster screw
- 27. Screw
- 28. Stud bolt
- 29. O-ring
- 30. O-ring
- 31. Bolt
- 32. Retainer
- 33. Lock nut
- 34. Bearing cup

WARNING Take care when using a press to compress the washers when removing the circlip. Release pressure slowly when circlip removed.



22. Using a suitable press and special tool Part No, CA715056, apply pressure to piston (39) and remove circlip (35).

23. Remove sleeve (36) and belleville washers (37).

WARNING Hydraulic or air pressure can be used to remove the brake piston. Only use the minimum pressure necessary to move piston.



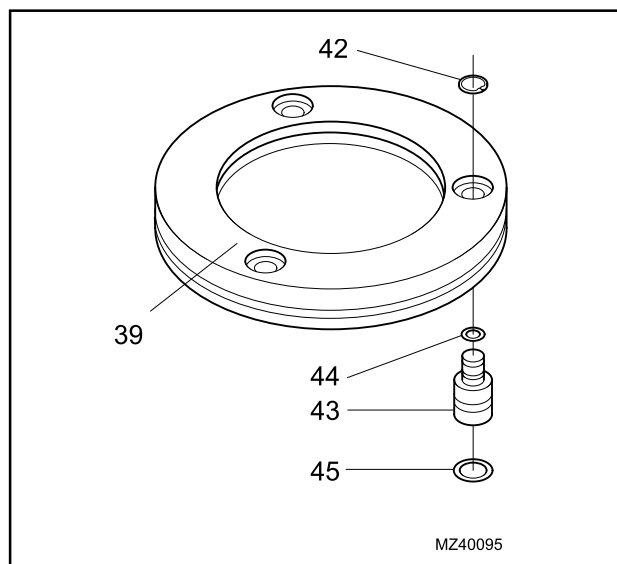
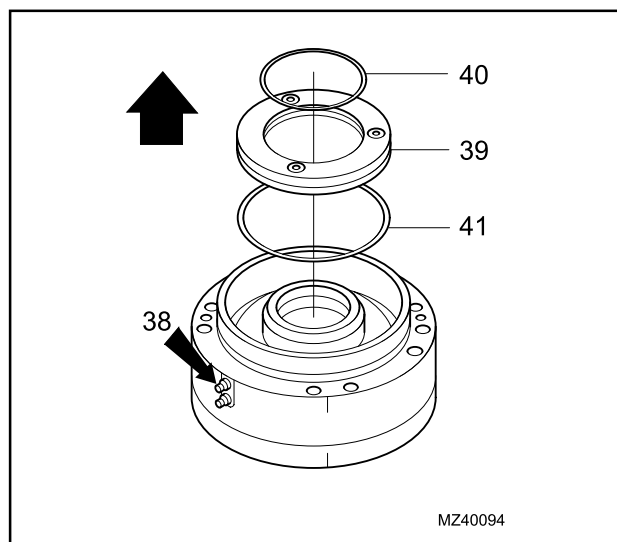
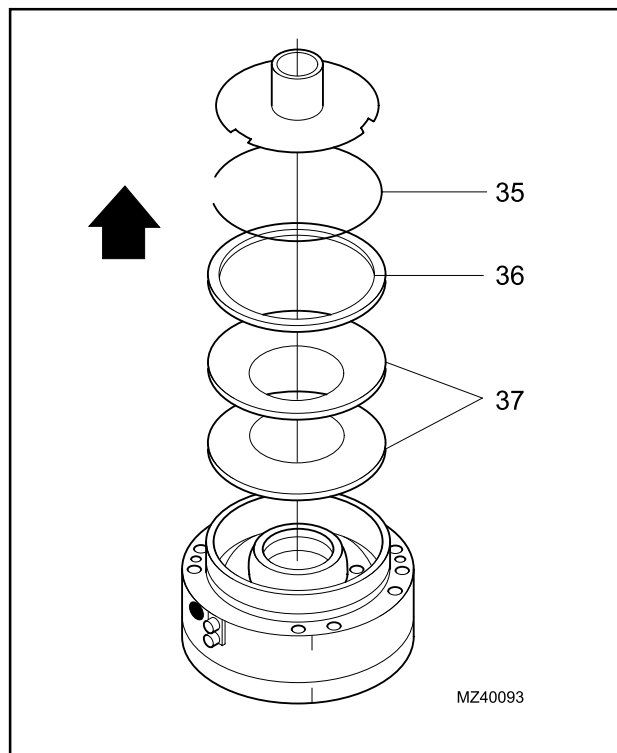
24. Attach a suitable hydraulic or air supply to the negative acting brake connection (38) on the brake pack (12). Apply the minimum pressure to move the piston.

25. Remove the piston (39) and remove the O-rings (40 & 41) from piston.

26. Remove circlip (42) securing thrust pin (43) to piston and remove thrust pin.


27. Remove O-rings (44 & 45) from thrust pin and inspect for wear.

28. Remove the other axle beam trumpet and brake group from the differential unit using the above procedure.




- 35. Circlip
- 36. Sleeve
- 37. Belleville washer (Qty 2)
- 38. Brake connection
- 39. Piston
- 40. O-ring
- 41. O-ring
- 42. Circlip
- 43. Thrust pin
- 44. O-ring
- 45. O-ring

Differential group

WARNING  *When the crown wheel is removed from differential unit the two halves will separate. Make sure component parts are not dropped.*

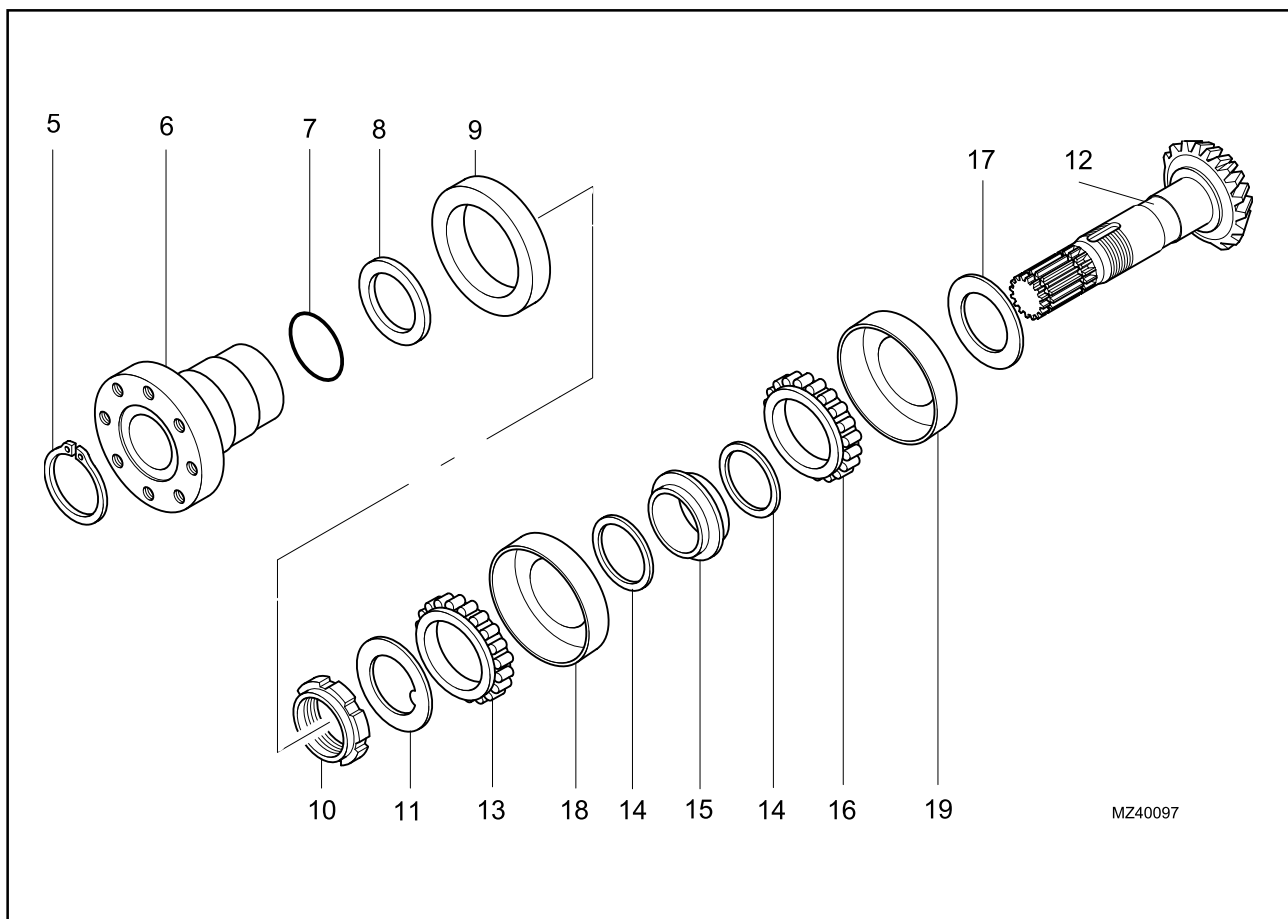
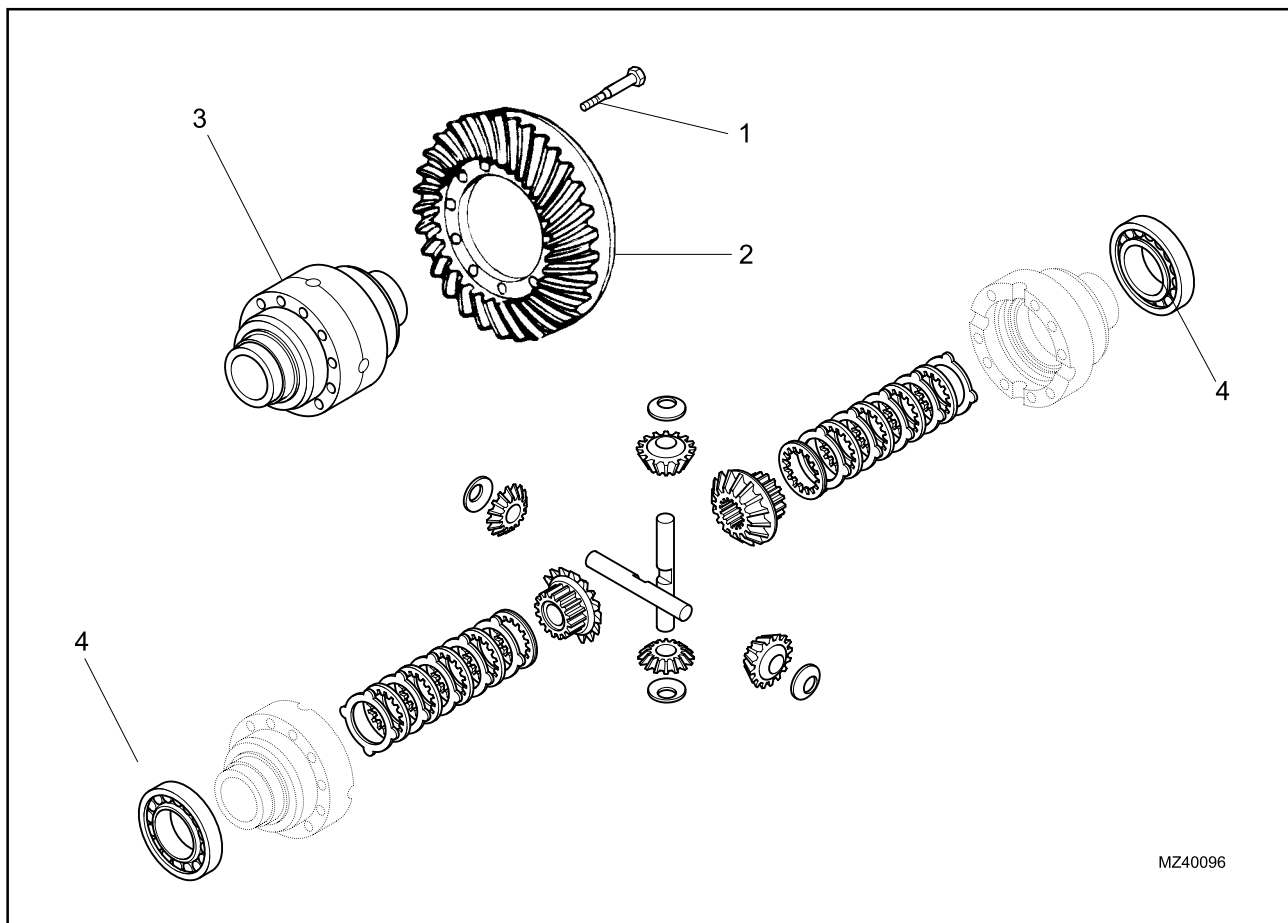
NOTE: Mark the two halves of the differential (3) before dismantling to aid assembly.

1. Remove the differential (3) from the housing and secure in a suitable clamp.
2. Remove the bolts (1) securing the crown wheel (2) to the differential (3) and remove the crown wheel.
3. Carefully separate the two halves of the unit.
4. Dismantle the components in each differential half and examine for wear.
5. Remove the bearing (4) from each half of the unit with a suitable extractor.
6. Remove the circlip (5), and slide out the input flange (6). Remove the O-ring (7) and shim (8).
7. Use an extractor and remove the bearing seal (9).

WARNING  *Always use the special tools to remove the bevel pinion ring nut. Other methods can damage the threads.*

8. Remove the bevel pinion ring nut (10) using special tool Part No. CA119099 and CA715022, then remove the washer (11).
9. Remove the pinion (12) from the housing by using a soft-faced hammer to drive pinion into housing. Remove the taper roller bearing (13) from the splined end of the housing.
10. Remove the washers (14) and collapsible spacer (15) from the pinion shaft. Remove the taper roller bearing (16) from the pinion shaft (12).
11. Remove the shim (17) from under the inner bearing on the pinion shaft and check for wear.
12. Remove the outer bearing track (18) using a suitable extractor.
13. Remove the inner bearing track (19) using a suitable hammer and drift.

1. Bolt
2. Crown wheel
3. Differential assembly
4. Bearing
5. Circlip
6. Input flange
7. O-ring
8. Shim
9. Bearing seal
10. Pinion ring nut
11. Washer
12. Pinion
13. Taper roller bearing
14. Washer
15. Collapsible spacer
16. Taper roller bearing
17. Shim
18. Outer bearing track
19. Inner bearing track



ASSEMBLY

Pinion group

1. Position the differential housing (1) on a workbench.

2. Fit the outer bearing track (2) and inner bearing track (3) for the taper roller bearings in the housing using special tool in kit Part No. CA715401.

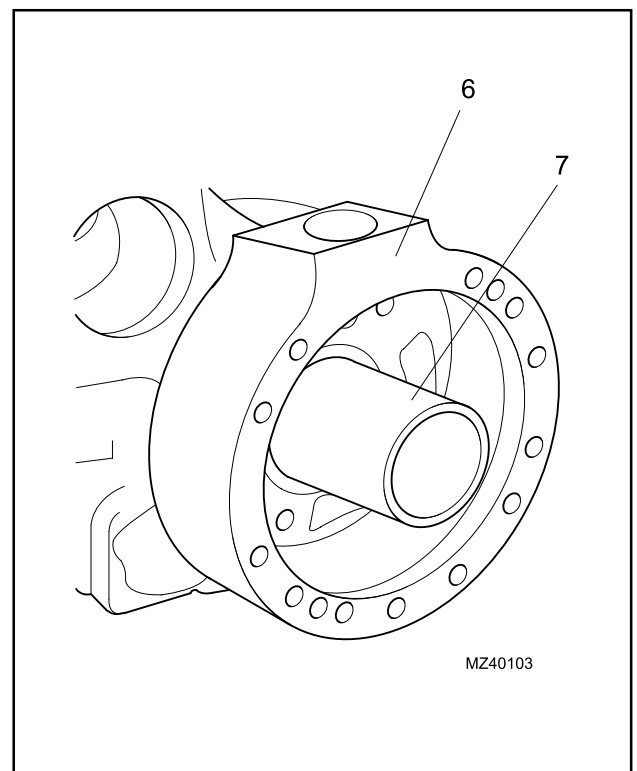
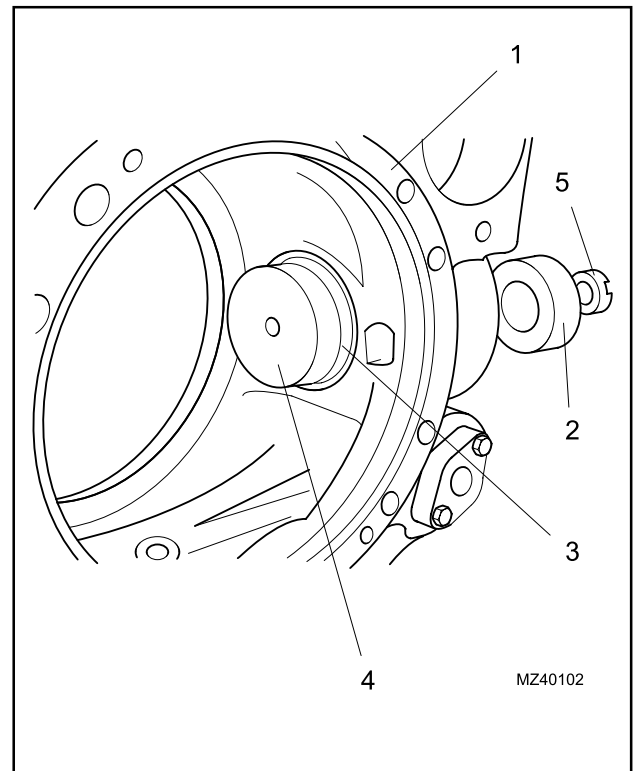
NOTE: To measure and set up the differential, a false pinion Part No. CA715040 and a false differential Part No. CA715041 are used.

3. Fit the false pinion Part No. CA715040 (4) complete with bearings to the differential housing and tighten ring nut (5) until backlash is eliminated (do not over-tighten ring nut).

NOTE: Make sure the brake housings are fitted to the correct side of the differential and the reference marks made during disassembly are aligned.

4. Fit the left and right brake housings (6) to the differential. Use at least two bolts to attach each half, space the bolts diametrically opposite to make sure housing is seated correctly.

5. Fit the false differential (7) Part No. CA715041 to the centre body of the differential housing and make sure it is inserted in both brake housings.



1. Differential housing
2. Outer bearing track
3. Inner bearing track
4. Special tool Part No. CA715040
5. Ring nut
6. Brake housing
7. False differential Part No. CA715041

5. Using a depth gauge through the central hole in the false pinion, calculate dimension **X** by using the following formula:

X = (conical distance to be measured)

A = (measured value)

B = (known value) = 100 mm

C = (known value) = 45 mm

$$(A + C) - B = X$$

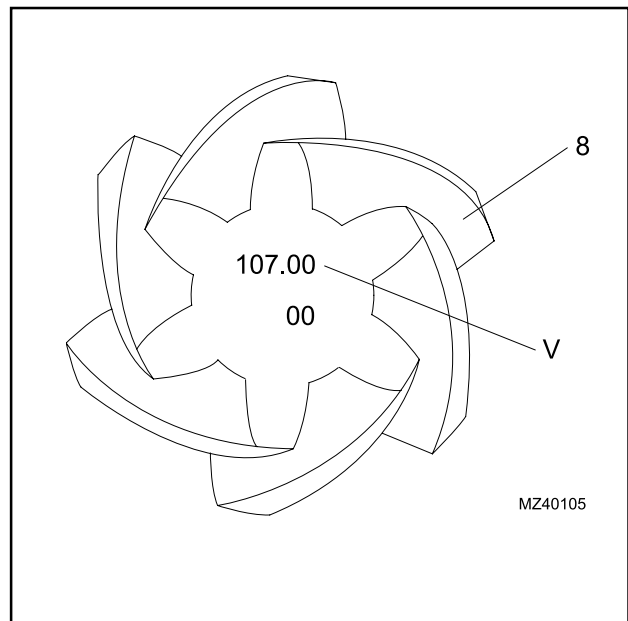
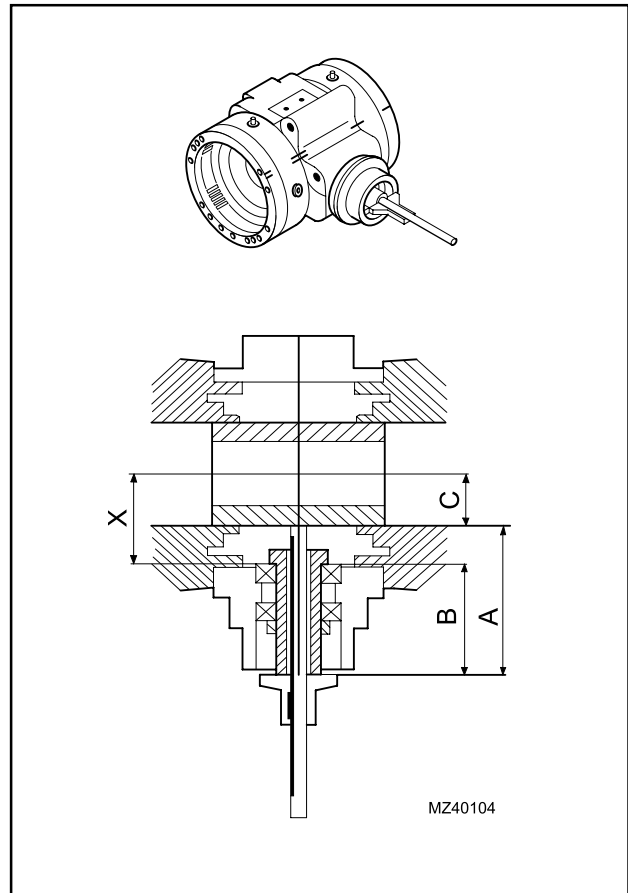
Example: **A** = 164.9 mm

Therefore: **X** = [(164.9 + 45) – 100] = 109.9 mm

To calculate the shim (**S**) necessary between the pinion and bearing, subtract the (**V**) value stamped on the pinion head (8) (**V** = requested conical distance) from the (**X**) calculated value.

$$S = X - V$$

Example: thickness **S** = 109.9 – 107.00 = 2.9 mm



8. Pinion

6. Remove the false differential (7), Part No. CA 715041, from the centre body of the differential housing.

7. Remove the left and right brake housings (6) from the differential.

8. Remove the ring nut (5) and the false pinion Part No. CA715040 (4) complete with bearings from the differential housing.

NOTE: Shims are available in the following thickness, 2.5, 2.6, 2.7, 2.8, 2.9, 3.0, 3.1, 3.2, 3.3 and 3.4 mm.

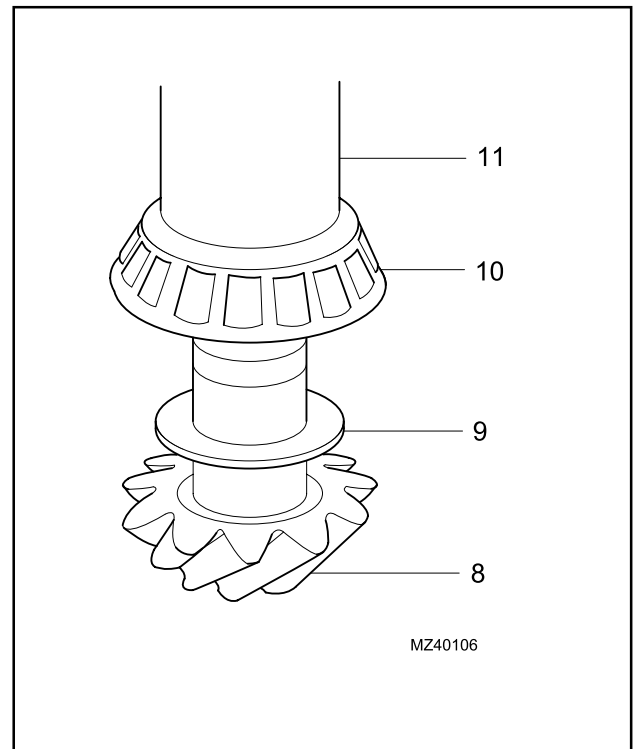
9. Select a shim (9) (from the calculation for **S**) and fit to pinion (8) with chamfer of shim next to pinion gear.

10. Fit inner bearing race (10) to pinion using special tool (11) Part No. CA715179 and a suitable press, make sure bearing is fully pressed onto pinion.

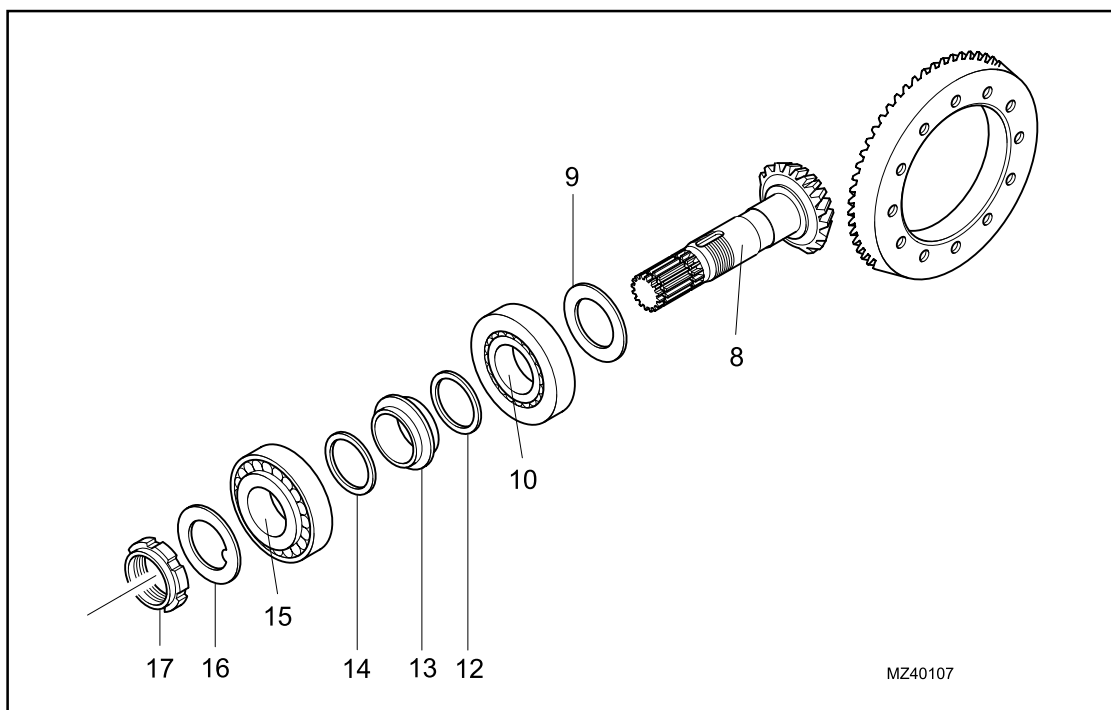
11. Fit a washer (12), collapsible spacer (13) and washer (14) to the pinion shaft.

NOTE: When seating the outer bearing, support the pinion with a suitable reaction weight (e.g. a sledge hammer).

12. Fit pinion into differential housing and fit outer bearing race (15) onto pinion. Use special tool, Part No. CA715179, and a hammer to fully seat the pinion.



- 9. Shim
- 10. Inner bearing race
- 11. Special tool Part No, CA715179
- 12. Washer
- 13. Collapsible spacer
- 14. Washer
- 15. Outer bearing race
- 16. Washer
- 17. Ring nut



WARNING *The torque setting is achieved by the pre-loading measurement on the bearings. Check the pre-loading then gradually increase the torque load on the pinion ring nut until the correct pre-loading is achieved. If the pre-loading is exceeded, the collapsible washer must be replaced and the process started again.*



13. Fit a new ring nut washer (16) and ring nut retainer.

14. Fit a new ring nut (17). Hold ring nut retainer with special tool Part No. CA715022, tighten ring nut with special tool Part No. CA119099. Tighten ring nut in small steps and check the pre-loading with special tool Part No. CA715116 fitted to pinion shaft.

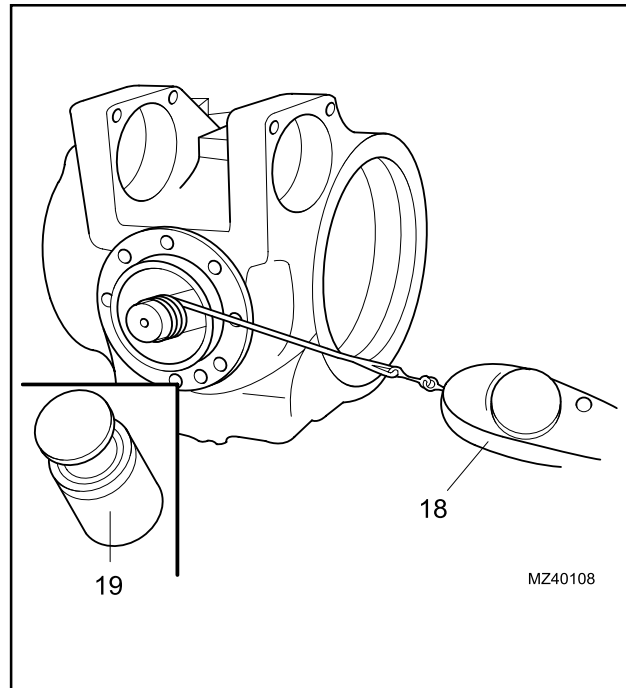
WARNING *The seal ring must not be fitted when the pre-loading is checked.*



15. Measure the pre-loading measurement (**P**) pinion taper roller bearings, using a dynamometer (18) with the cord wound on the 80 mm diameter of special tool.

16. When the correct pre-loading value is achieved,peen the ring nut using a hammer and chisel.

$$P = 9.2 \div 13.8 \text{ daN}$$



- 18. Dynamometer
- 19. Special tool Part No, CA715116

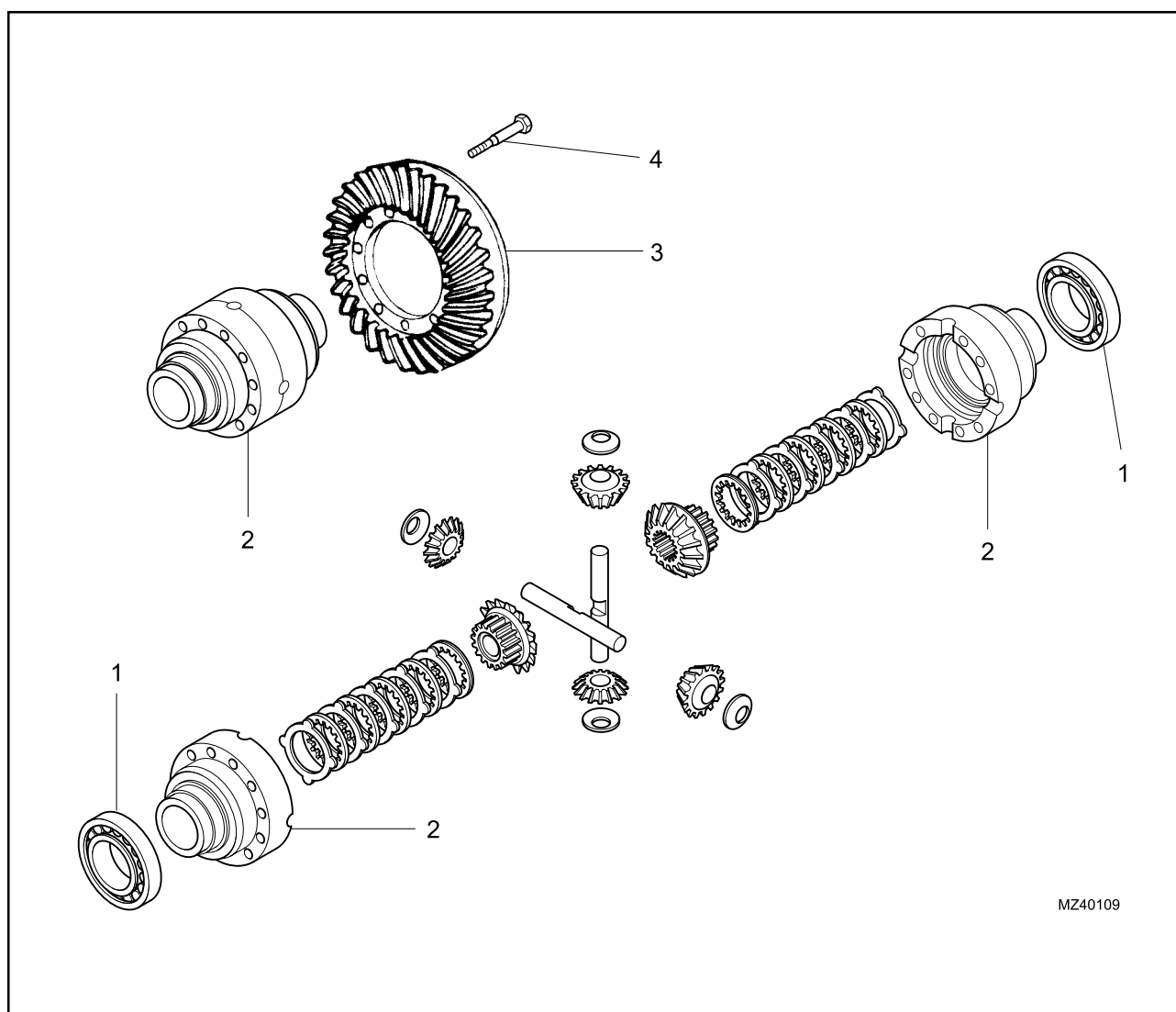
Differential group

1. Fit the taper roller bearing (1) to each half of the differential housing (2). Fit special tool Part No, CA 119230 to bearing and use a hammer to make sure bearing is fully pressed onto housing.

2. Position each half box on a bench and assemble all inner components (sun gears, planetary gears, thrust washers, pins, discs and fixed discs) as in illustration.

3. Fit crown wheel (3) to differential housing (2).

4. Apply Loctite 270 to bolt thread (4) and secure crown wheel to differential unit. Torque load bolts to 95 Nm (70 lbf ft.).



MZ40109

1. Taper roller bearing
2. Differential housing
3. Crown wheel
4. Bolt

Brake pack and differential housing

NOTE: The following assembly procedure, for the brake pack, must be carried out on both left and right units.

1. Position flange of brake pack (1) on a flat surface and fit the bearing track (2) to brake pack using special tool Part No. CA715299, handle Part No. CA119033 and a hammer.


2. Fit O-rings (3 & 4) to the three thrust pins (5).


3. Fit the thrust pins to the negative acting brake piston (6) and secure with circlips (7).

4. Fit O-rings (8 & 9) to the inner and outer faces of the negative acting brake piston.

NOTE: Use an eyebolt screwed into the brake pack, and a lever to press the piston into the brake pack.

5. Apply a thin layer of grease to the piston contact surfaces and O-rings. Position piston on brake pack and using special tool Part No. CA715056, (10) press piston into brake pack until it is just located, then remove special tool.

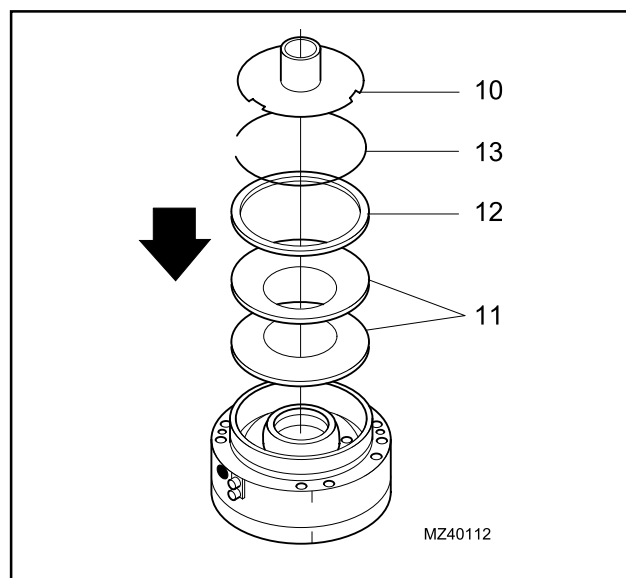
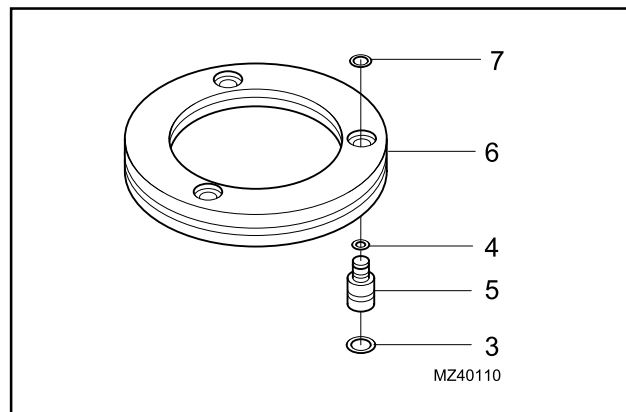
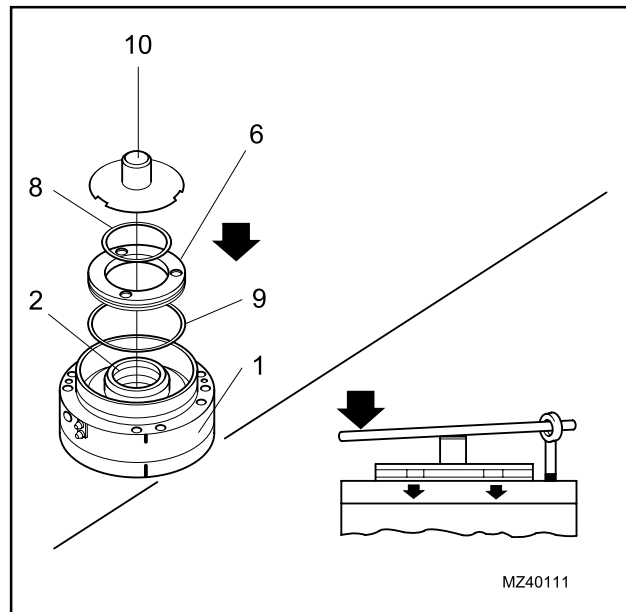
WARNING  Take care when compressing the belleville washers, use a press and make sure all components are square before applying pressure.

CAUTION  The upper belleville washer must be fitted with the concave side facing up.

6. Position the brake pack on a suitable press, fit the belleville washers (11) (the lower washer should have the concave side facing down and the upper washer should have the concave side facing up). Fit the sleeve (12) (with the ring seat outermost).

7. Position the special tool Part No. CA715056, (10) on assembly and press into brake pack until circlip (13) can be fitted. Fit circlip and carefully release press. Make sure belleville washers are located centrally.

1. Brake pack
2. Bearing track
3. O-ring
4. O-ring
5. Thrust pin (Qty 3)
6. Negative acting brake piston
7. Circlip



8. O-ring
9. O-ring
10. Special tool, Part No. CA715056
11. Belleville washer (Qty 2)
12. Sleeve
13. Circlip

8. Fit split bushes (14) to piston (15).

9. Fit the O-rings (16 & 17) to the piston and lubricate piston faying surfaces and O-rings with a thin layer of grease.

NOTE: Carry out the following steps to all three brake release bolts.

10. Lubricate the O-ring (18) with grease and fit to bolt (19). Fit the pin (20) and bolt (19) to the brake pack.

NOTE: The pin (20) must seat on the negative acting brake piston (6). Hydraulic pressure must be applied to the negative acting brake piston to allow the bolts to be screwed in completely.

11. Connect a suitable hydraulic pressure supply to the brake pressure connection (21) and apply a pressure of 20 bar (290 psi).

12. Screw the adjuster bolts (19) fully in.

13. Release hydraulic pressure, then push the negative acting brake piston (6) until it contacts the pins (20).

14. Apply Loctite 518 to threads of screw (22), fit to brake pack and torque load to 30 Nm (22 lbf ft.).

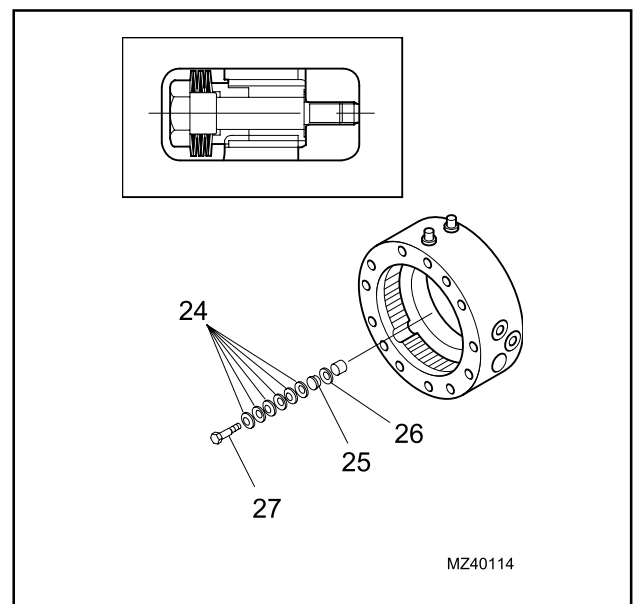
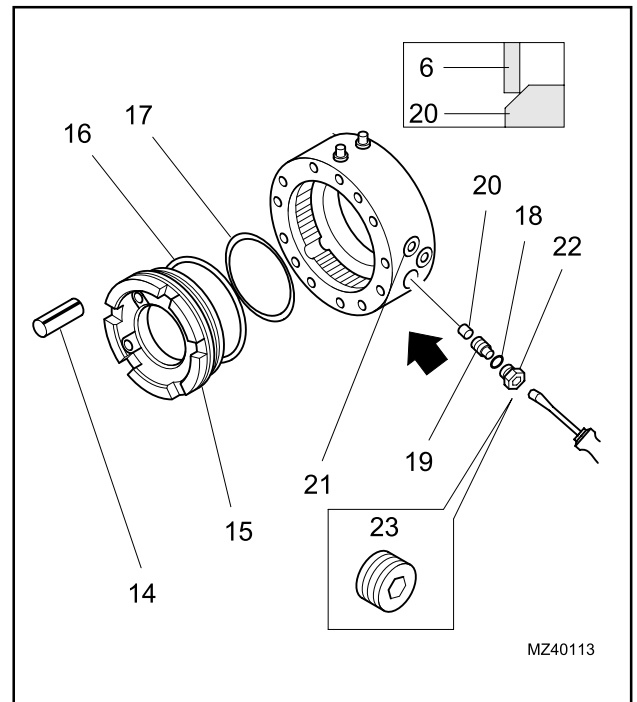
15. Fit plug (23) to screw (22) and torque load to 20 Nm (15 lbf ft.).

16. Fit piston (15) into brake pack (1) and using special tool Part No. CA715056, press piston into brake pack until it is just engaged.

NOTE: Make sure the belleville washers are fitted in the correct orientation on the bolt.

17. Assemble the belleville washers (24), bush (25) and belleville washer (26) to the bolt (27).

18. Fit the three bolts (27) to the piston (15) and torque load to 10 Nm (7.5 lbf ft.).



- 14. Split bush (Qty 3)
- 15. Piston
- 16. O-ring
- 17. O-ring
- 18. O-ring
- 19. Bolt
- 20. Pin
- 21. Brake pressure connection
- 22. Screw
- 23. Plug
- 24. Belleville washers
- 25. Bush
- 26. Belleville washer
- 27. Bolt

WARNING *Make sure the differential is inserted in the correct side of the casing.*



19. Fit new O-rings (28 & 29) to the brake pack (1).

20. Insert a suitable size bar through the differential assembly (30) and slide assembly into differential housing (31).

CAUTION



During assembly, make sure the brake packs are assembled to the correct side of the housing and the alignment marks made during dismantling are aligned.

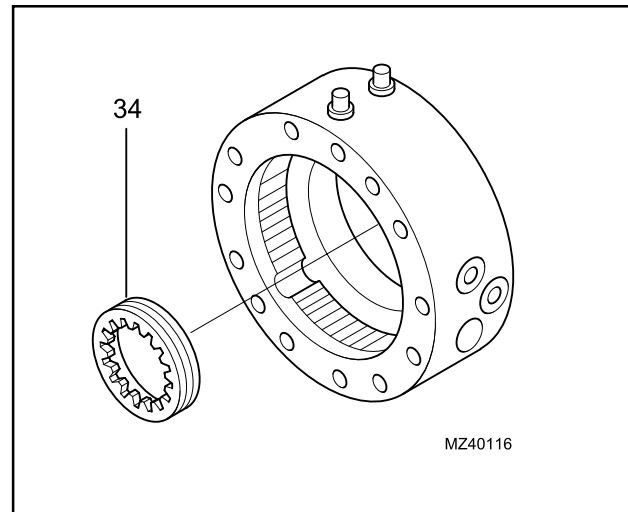
21. Fit the brake pack (1) to the crown wheel side of the housing. Make sure the alignment marks made during dismantling are aligned. Secure with the upper bolt (32) and the lower stud bolt (33). Torque the upper bolt (32) to 80 Nm (59 lbf ft.). Torque the lower stud bolt (33) to 120 Nm (88 lbf ft.).

22. Remove the bar from the differential assembly.

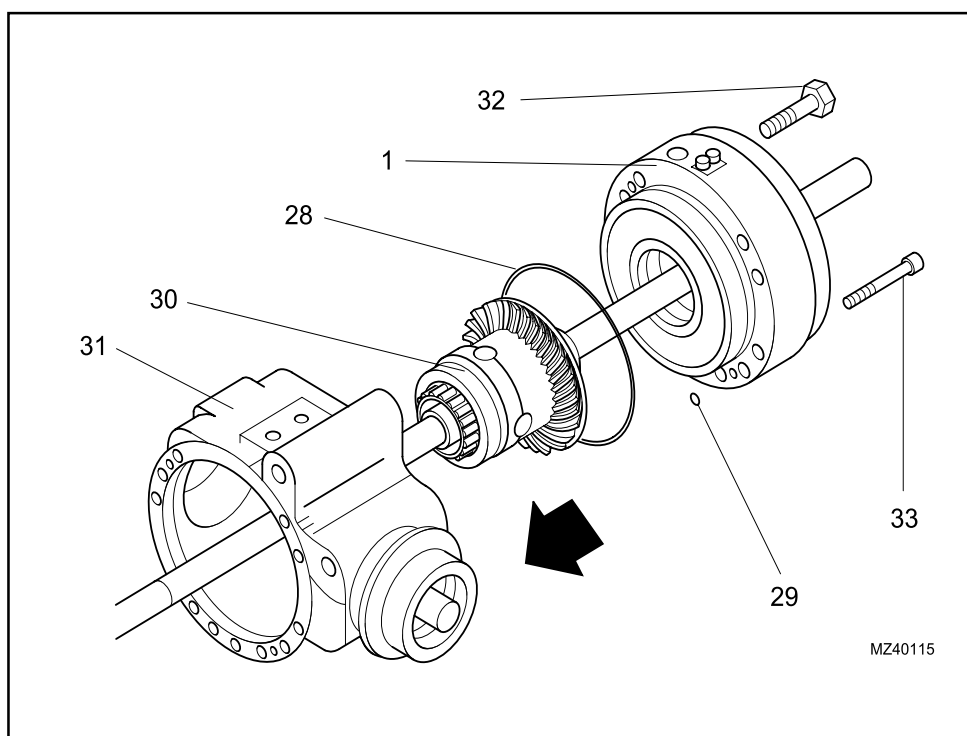
23. Fit the brake pack (1) to the other side of the housing. Make sure the alignment marks made during removal are aligned. Secure with the upper bolt (32) and the lower stud bolt (33). Torque the upper bolt (32) to 80 Nm (59 lbf ft.). Torque the lower stud bolt (33) to 120 Nm (88 lbf ft.).

NOTE: The next stage involves fitting the pinion adjusting ring nuts, tighten the ring nuts evenly from both sides until backlash has been eliminated. Do not over tighten the ring nuts.

24. Fit a ring nuts (34) to both sides of the housing and evenly tighten until backlash is eliminated.



- 28. O-ring
- 29. O-ring
- 30. Differential assembly
- 31. Differential housing
- 32. Bolt
- 33. Stud bolt
- 34. Ring nut



25. Assemble special tool Part No. CA715146 on pinion end.

26. Move the pinion end alternatively and note the pinion-ring gear backlash, measured with the comparator, so that the feeler is in contact with, and at 90° to, the bracket surface of the special tool in correspondence with the reference mark.

27. Check if the measured backlash is within the required range.

0.21 – 0.27 mm

28. Carry out adjustments, by turning the two ring nuts (34), using special tool Part No. CA 119030.

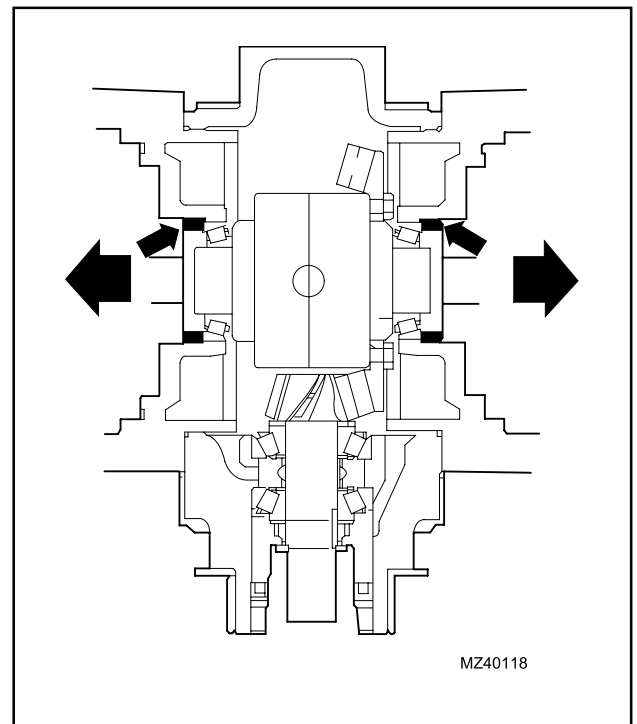
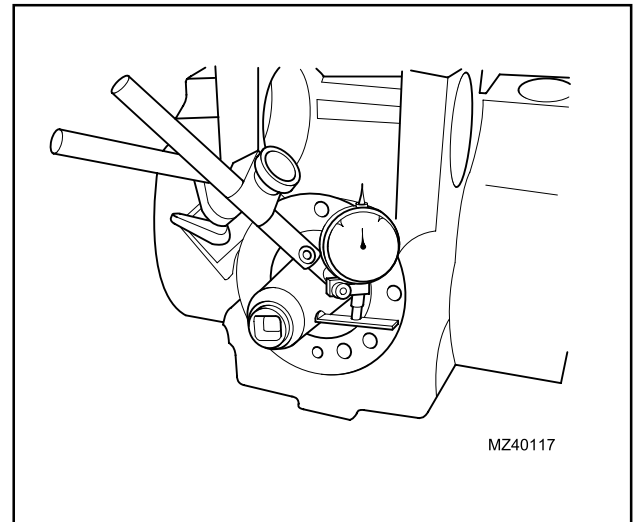
29. Adjust the ring nuts (34), remembering that:

- ✱ If the **measured backlash is less** than the given tolerance range, move the crown wheel towards the pinion by screwing the ring nut on the crown wheel side in and screwing the opposite ring nut out by the same amount.

- ✱ If the **measured backlash is more** than the given tolerance range, move the crown wheel away from the pinion by screwing the ring nut on the crown wheel side out and screwing the opposite ring nut in by the same amount.

30. When the pinion ring gear backlash is correct, check that there is a minimum pre-loading on the differential box bearings.

31. Repeat the above adjustment procedure until the backlash is correct.



WARNING *Pre-loading checks should be measured without the seal ring fitted.*



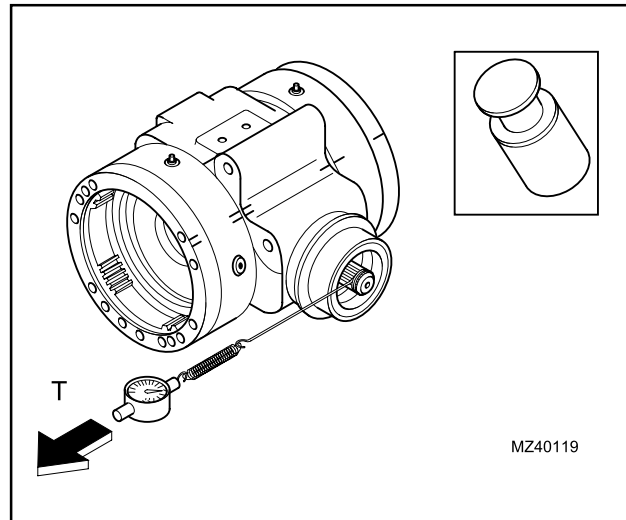
32. With the pinion-ring gear backlash set, measure the total pre-loading (**T**) of the bearings (pinion-ring gear system), using a dynamometer whose cord is wound on the 80 mm diameter of special tool Part No, CA715116. The measured value should be within the following range:

$$T = (P + 3.85) \div (P + 5.8) \text{ daN}$$

Where (**P**) is the pre-loading effectively measured on the pinion (see Pinion Assembly).

33. If the measurement is not within the required range, check for correct assembly of components and adjust the differential support ring nuts as follows:

- ✱ If the **total pre-loading is less** than the required range, tighten the two ring nuts by the same amount, keeping the pinion ring-gear backlash unchanged.
- ✱ If the **total pre-loading is higher** than the required range, unscrew the two ring nuts by the same amount, keeping the pinion ring-gear backlash unchanged.



Generic information

To test the marks on the bevel gear teeth, paint the ring gear with red lead paint.

The marking test should always be carried out on both sides of the ring bevel gear teeth.

OK = Correct contact

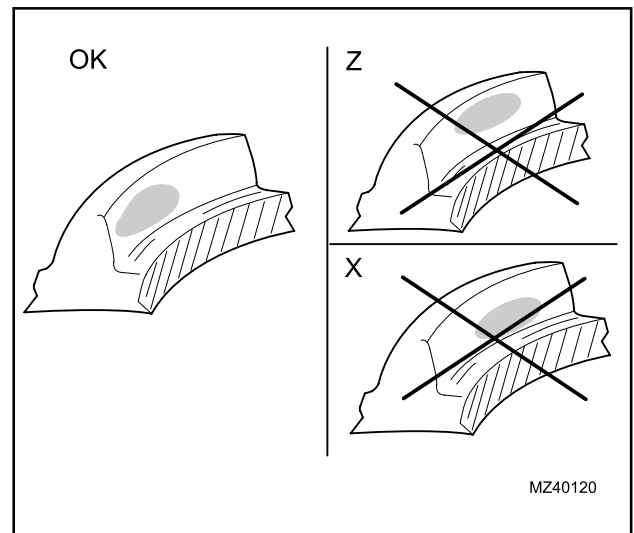
If the bevel gear is well adjusted, the mark on the teeth surfaces will be regular.

Z – Excessive contact on the tooth tip.

Move the pinion towards the ring bevel gear and then move the ring bevel gear away from the pinion in order to adjust the backlash.

X – Excessive contact on the tooth base.

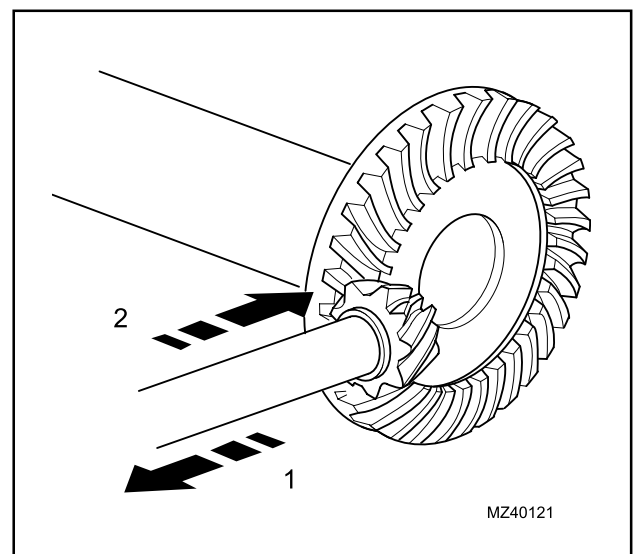
Move the pinion away from the ring bevel gear and then move the ring bevel gear towards the pinion in order to adjust the backlash.



Correction movements

1 – move the pinion for type **X** contact adjustments.

2 – move the pinion for type **Z** contact adjustments.



NOTE: The ring nut may have to be turned slightly to enable the retaining screw to be fitted.

34. Fit the ring nut retainer (35) to secure ring nut (34) to housing and secure with the bolt (36), turn ring nut slightly to align bolt hole, if necessary. Torque load bolt to 13 Nm (9.6 lbf ft.).

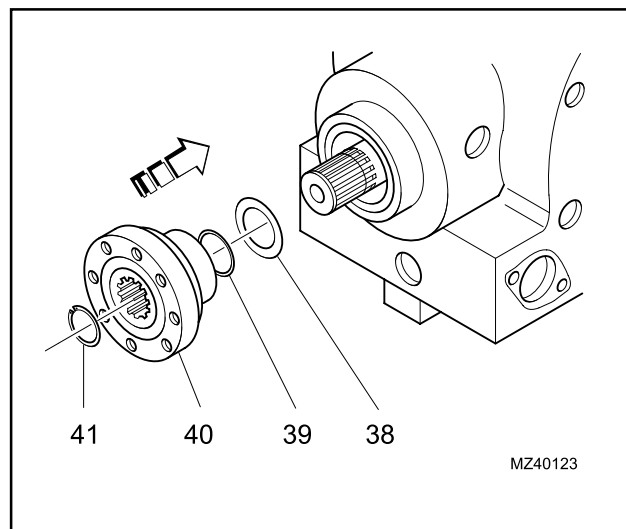
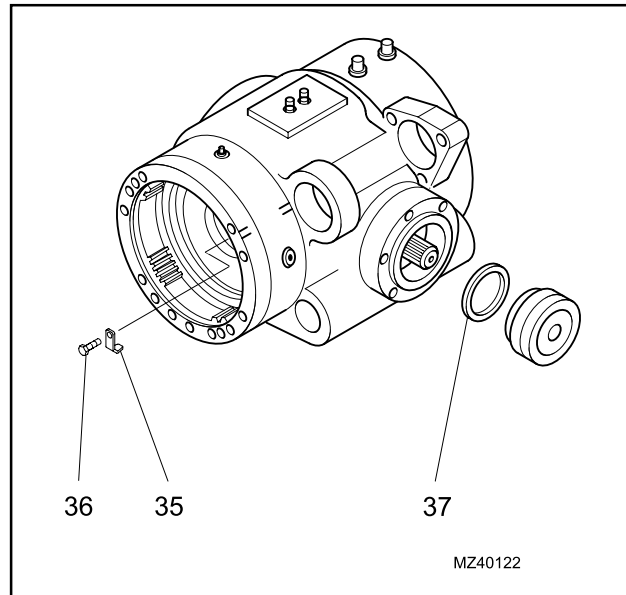
35. Repeat previous step to other ring nut.

36. Fit bearing seal (37) to the pinion drive using special tool Part No, CA715156.

37. Fit the shim (38) to the pinion.

38. Apply a thin film of oil to the lip of the seal (37) and O-ring seal (39) and fit to pinion shaft.

39. Fit input flange (40) to pinion and secure with circlip (41).



- 35. Retainer
- 36. Bolt
- 37. Bearing seal
- 38. Shim
- 39. O-ring
- 40. Input flange
- 41. Circlip

Axle beam trumpet and brake group

NOTE: This procedure is for the left or right hand axle beam trumpet and brake group.

1. Examine the brake discs and fixed discs for wear, replace if necessary.

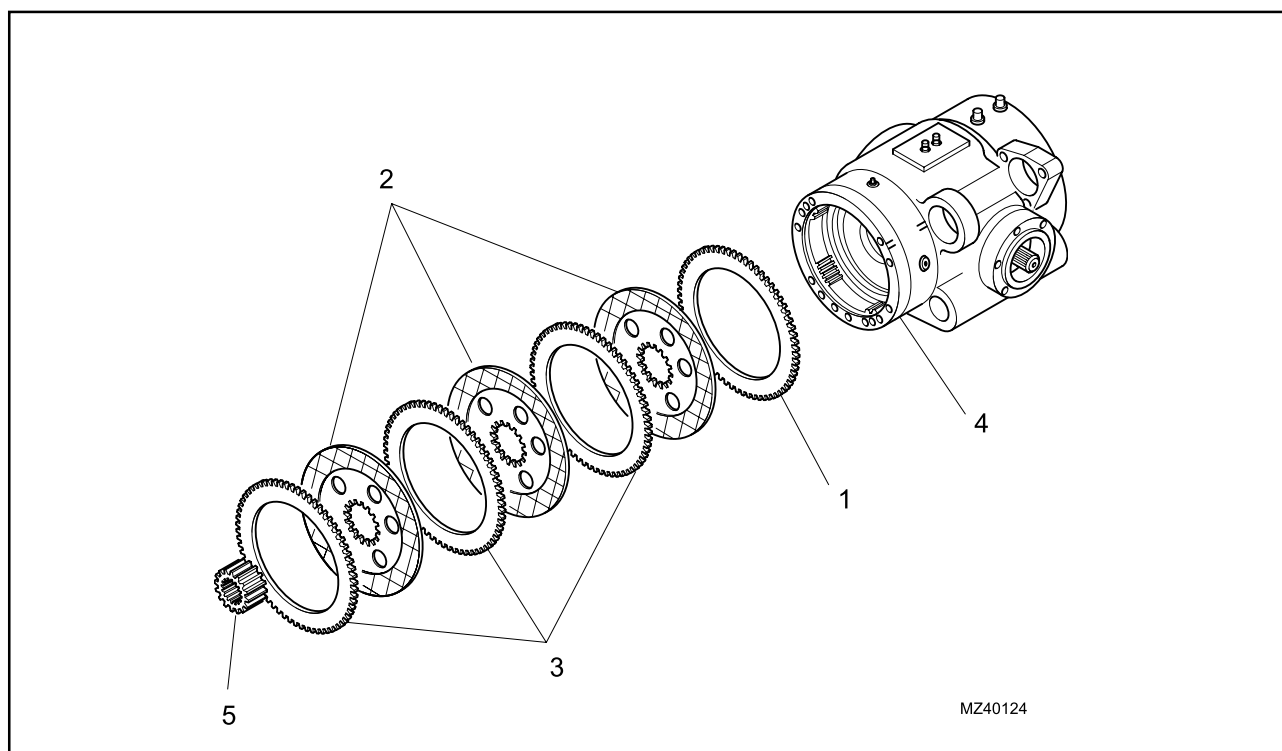
NOTE: When new brake discs are fitted, they must be soaked in oil before use.

2. Examine the friction discs and fixed discs for signs of burning or damage, replace if necessary.

3. Position the axle on a suitable workbench and attach lifting gear to the axle beam to be fitted.

4. Fit the inner brake drive plate (1), brake discs (2) and fixed discs (3) to the brake pack (4).

5. Fit the sleeve (5) to the brake discs in the position noted during dismantling.



- 1. Brake drive plate
- 2. Brake disc
- 3. Fixed disc
- 4. Brake pack
- 5. Sleeve

6. Fit O-ring (6) to axle beam.

WARNING



The axle beams is heavy. Take care when fitting axle beam to differential and use suitable lifting gear. Make sure the axle beam is fitted to the correct side of the differential and the alignment marks made during dismantling are lined up.

WARNING



Take care, when fitting the axle beam, not to dislodge the brake discs and fixed discs.

7. Using suitable lifting gear, position axle beam (7) on brake pack and secure with bolts (8). Torque load bolts to 320 Nm (236 lbf ft.).

8. Fit the nut (9) to the lower stud and torque load to 190 Nm (140 lbf ft.).

NOTE: When fitting bushes to the axle beam, it is advisable to cool bushes.

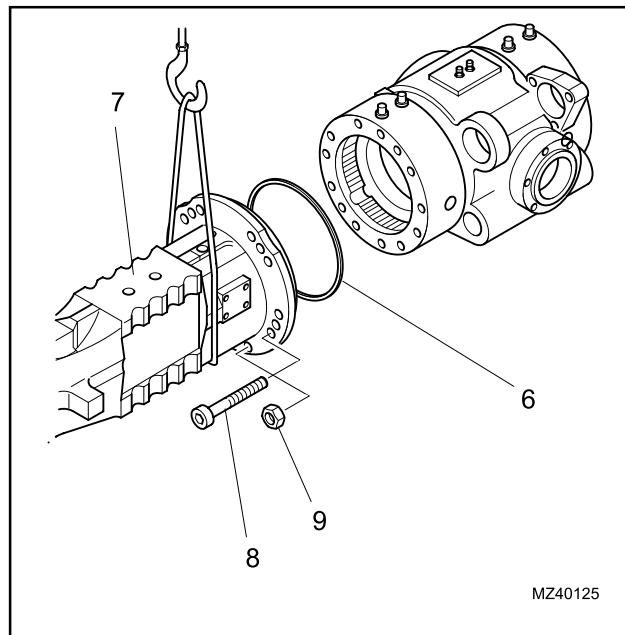
9. Fit upper and lower bushes (10 & 11) to axle beam (7) using special tool Part No, CA715039 and a hammer.

NOTE: Only fit bush (12) if it was removed at the dismantling operation.

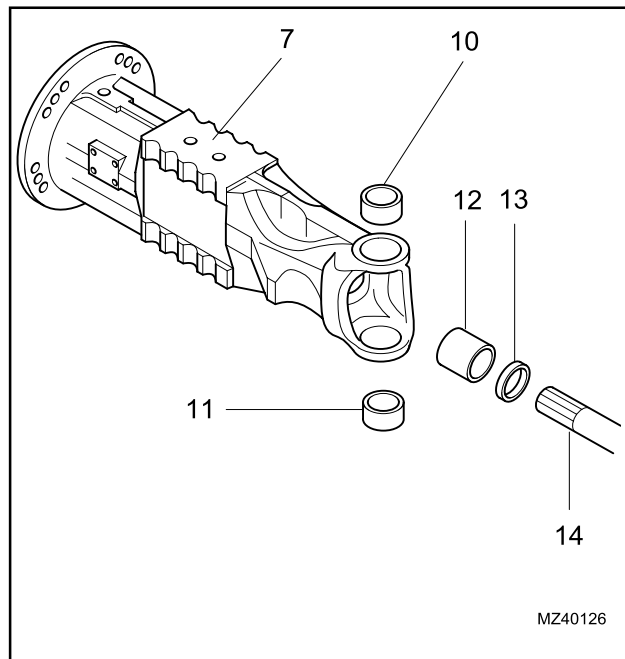
10. Fit bush (12) to axle beam (7) using special tool Part No, CA715157 and a hammer.

11. Fit sealing ring (13) to axle beam (7) using special tool Part No, CA715402 and a hammer. Fill $\frac{3}{4}$ of the seal cavity with grease.

12. Lubricate the bush (12) and sealing ring (13) with grease. Fit the drive shaft (14) to the axle to engage the differential.



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- 6. O-ring
- 7. Axle beam
- 8. Bolt
- 9. Nut
- 10. Bush
- 11. Bush
- 12. Bush
- 13. Sealing ring
- 14. Drive shaft

Wheel hub

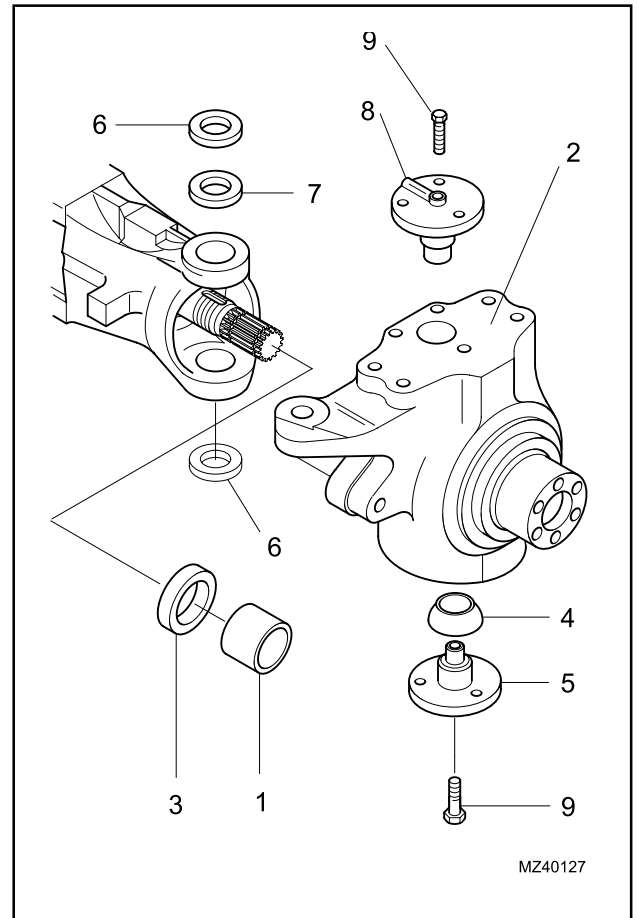
NOTE: This procedure is for the left or right hand wheel hub.

1. Fit the bush (1) in the swivel housing (2) with a hammer or a suitable press and special tool Part No. CA715108.
2. Fit the seal (3) in the swivel housing (2) with a hammer and special tool Part No. CA715321.
3. Fit the cone (4) of the spherical joint to the lower king pin (5) with a hammer or a suitable press and special tool Part No. CA715321.
4. Apply grease to the upper and lower king pin housings. Position a belleville washer (6) on the upper and lower king pin housing of the axle with shim (7) under the upper belleville washer.
5. Lubricate the seal lip (3) and protect the spline drive with tape to prevent damage to the seal.

WARNING *The swivel housing is heavy and must be supported with suitable equipment until the king pins are fitted.*



6. Support the swivel housing (2) with suitable lifting equipment and position on the axle housing. Make sure the belleville washers are not disturbed.
7. Fit the upper king pin (8) and secure with bolts (9). Torque load bolts to 300 Nm (221 lbf ft.).
8. Fit the lower king pin (5) and secure with bolts (9). Torque load bolts to 300 Nm (221 lbf ft.).
9. Remove the protective tape from the spline drive.



MZ40127

1. Bush
2. Swivel housing
3. Seal
4. Cone
5. Lower king pin
6. Belleville washer
7. Shim
8. Upper king pin
9. Bolt

10. Position the wheel hub (10) on a workbench and fit the bearing tracks (11 & 12) in the hub with a hammer or a suitable press and special tool Part No. CA715026.

11. Fit the inner taper roller bearing (13) to the hub and fit seal (14) with a hammer and special tool Part No. CA119143.

12. Fit the wheel hub to the swivel housing and fit the outer taper roller bearing (15) to the hub.

13. Position the wheel carrier (16) on a workbench and fit the bushes (17) in the hub with a hammer or a suitable press and special tool Part No. CA715027. Make sure the bushes are level with the carrier surface. Leave two diametrically opposed bushes slightly proud of the carrier to use as location dowels.

14. Fit the wheel carrier to the epicyclic ring (18) and secure with locking ring (19).

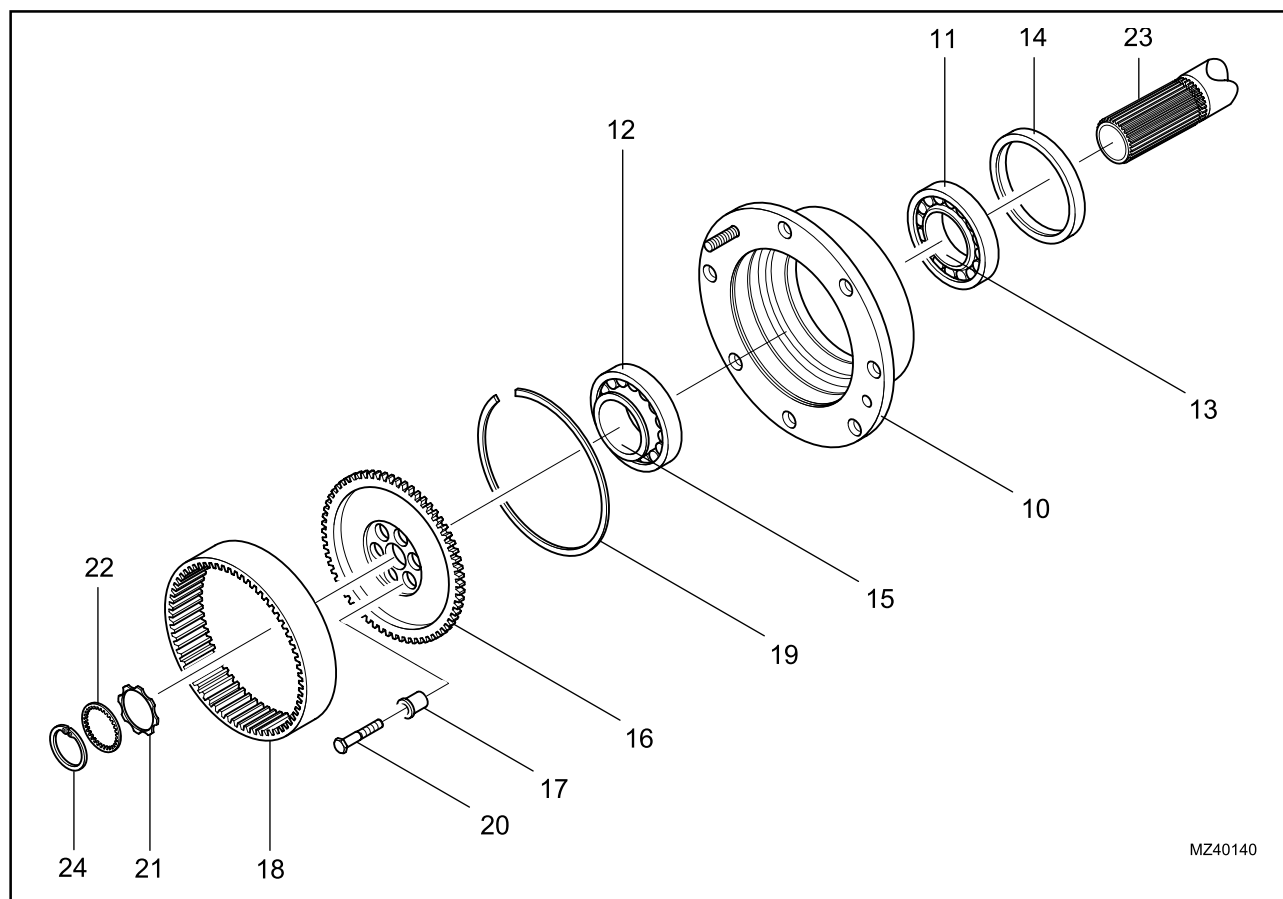
15. Locate the wheel carrier to the swivel housing, make sure the two bushes, left proud, engage in the holes on the carrier. Fit bolts (20) to these two positions, and tighten bolts to force bushes into swivel housing.

16. Press the remaining bushes into the swivel housing and secure with bolts (20). Torque load all bolts to 120 Nm (88 lbf ft.).

17. Slide the thrust washer (21), washer (22) onto the drive shaft (23) and secure with circlip (24).

18. Make sure the grease nipples are fitted to the kingpins, then grease the king pins.

- 10. Wheel hub
- 11. Bearing track
- 12. Bearing track
- 13. Inner taper roller bearing
- 14. Seal
- 15. Outer taper roller bearing
- 16. Wheel carrier
- 17. Bush (Qty 6)
- 18. Epicyclic ring
- 19. Locking ring
- 20. Bolt (Qty 6)
- 21. Thrust washer
- 22. Washer
- 23. Drive shaft
- 24. Circlip



Epicyclic reduction gear

NOTE: This procedure is for the left or right hand epicyclic reduction gear.

When a new planetary gear is fitted, it is recommended that new needle roller bearings are fitted.

1. Position the planetary carrier (1) on a clean workbench.

2. Fit the upper and lower needle roller bearings (2) to the planetary gears (3).

3. Fit planetary gears (3) to the pins (4), then fit thrust washers (5) and secure with circlip (or snapping) (6).

4. Fit new O-ring (7) to the planetary carrier (1).

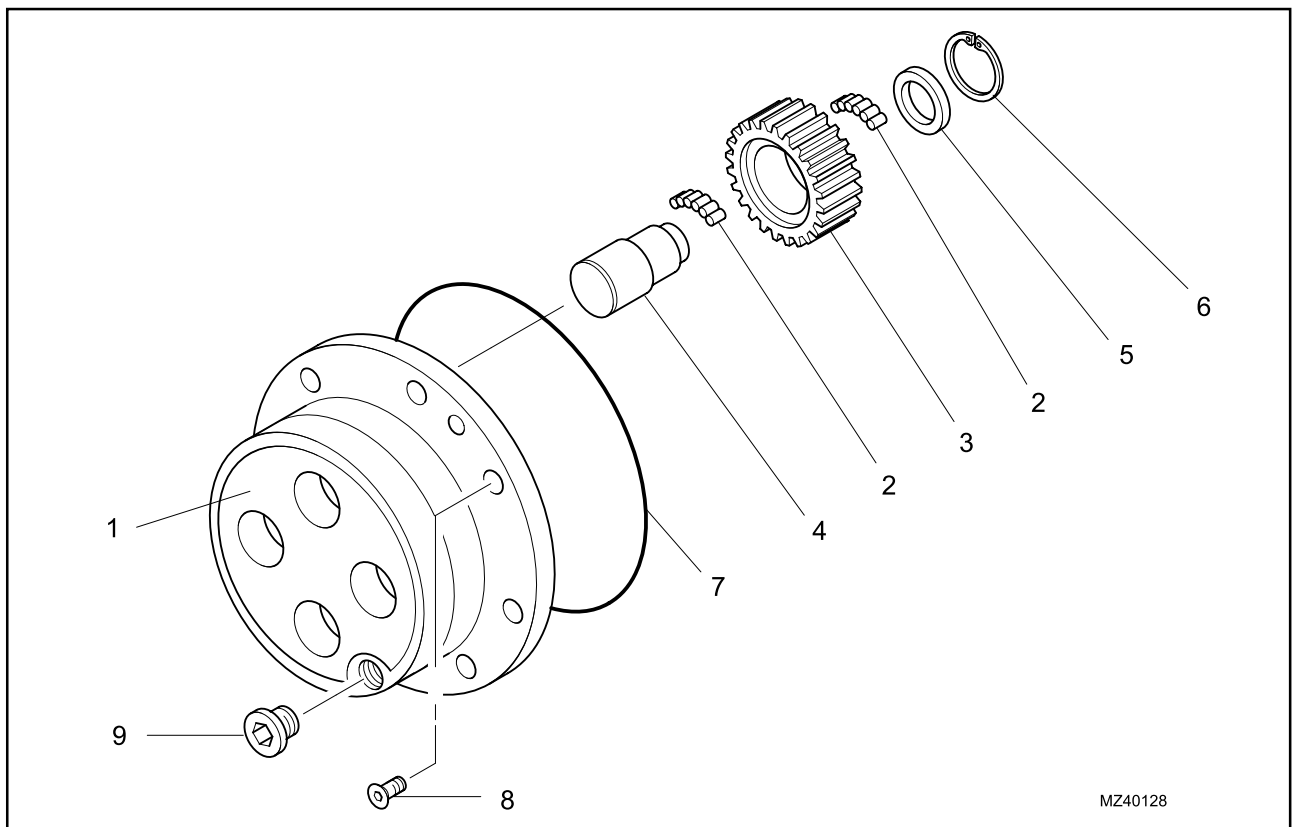
5. Fit the planetary carrier to the wheel hub and secure with retaining screws (8). Torque load retaining screws to 25 Nm (18 lbf ft.).

6. Fit drain plug (9) and torque load to 80 Nm (59 lbf ft.).

7. Refer to Service Manual and fill the hubs and differential unit with oil.

8. Test differential unit operation after installation to the machine.

1. Planetary carrier
2. Needle roller bearings
3. Planetary gear
4. Pin
5. Washer
6. Circlip
7. O-ring
8. Screw
9. Drain plug



Steering cylinder

1. Fit the swivel ends (1) to each end of the cylinder piston (2). Torque load to 300 Nm (221 lbf ft.).

2. Fit the steering cylinder (3) to the mounting brackets on the axle and secure with the three cylinder attachment bolts (4). Torque load bolts to 120 Nm (88 lbf ft.).

3. Fit the hydraulic adapter (5) to the steering cylinder (3).

4. Make sure the track rod lock nuts (6) are screwed towards the swivel ends.

5. Make sure the cylinder piston is central in the steering cylinder body.

6. Fit the track rod (7) to each swivel end (1).

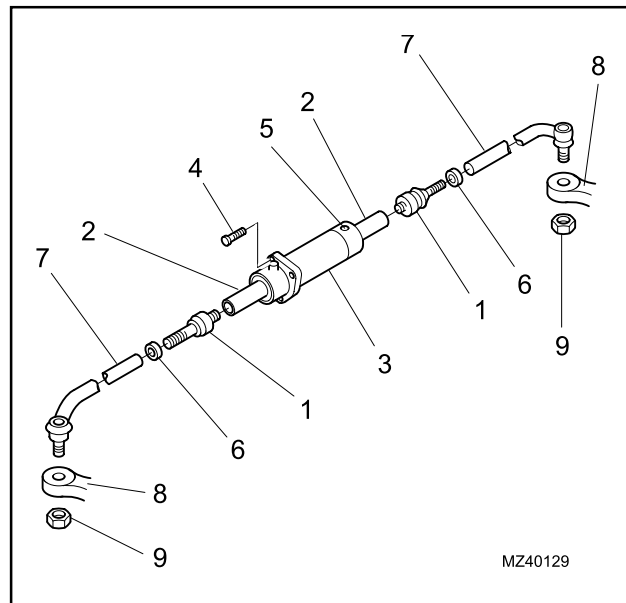
7. Make sure the swivel housings are parallel, then adjust the track rods until the ball joint can be fitted to the swivel housing.

8. Fit the track rod (7) to each swivel housing (8) and secure with a new nut (9). Torque load nuts to 220 Nm (162 lbf ft.).

NOTE: The inductive magnetic steering sensor is adjusted after the toe in adjustments. Locking clamps will be tightened at that stage.

9. Fit the inductive magnetic steering sensor, to the steering cylinder and secure with the locking clamps.

10. Check and adjust axle tracking.



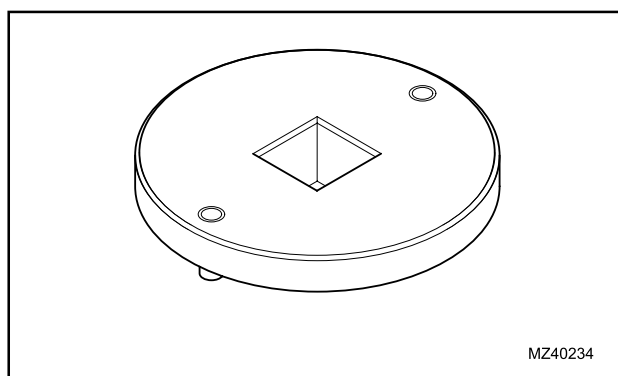
1. Swivel end
2. Piston
3. Steering cylinder
4. Bolt (Qty 3)
5. Hydraulic adapter
6. Lock nut
7. Track rod
8. Swivel housing
9. Nut

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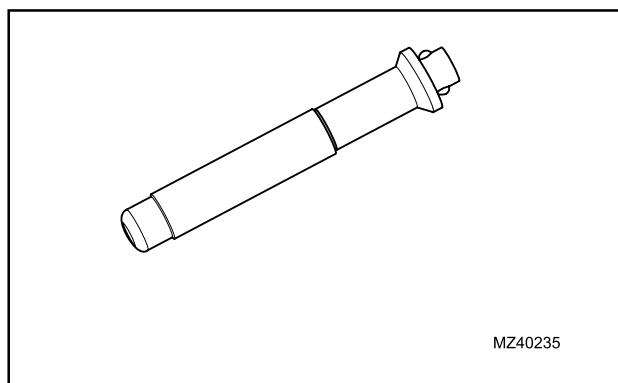
SPECIAL TOOLS

It is recommended that the correct special tools are used when dismantling and assembling the axle. The interchangeable handle Part No. CA119033 should always be used when removing and fitting bearings and bushes, together with a suitable safety handle.

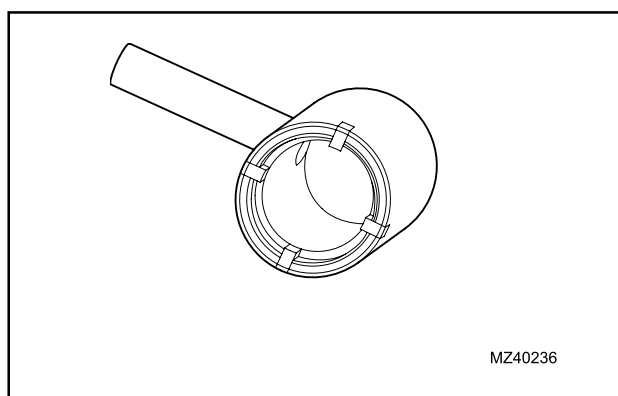
Ring nut wrench
CA119030



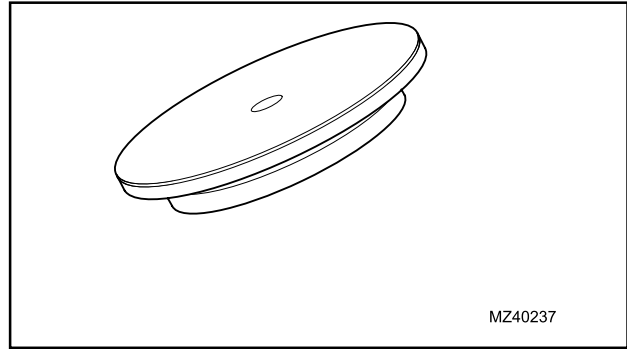
Interchangeable handle
CA119033



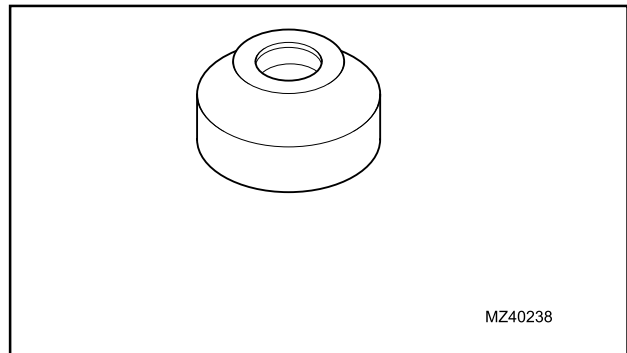
Pinion lock nut wrench
CA119099



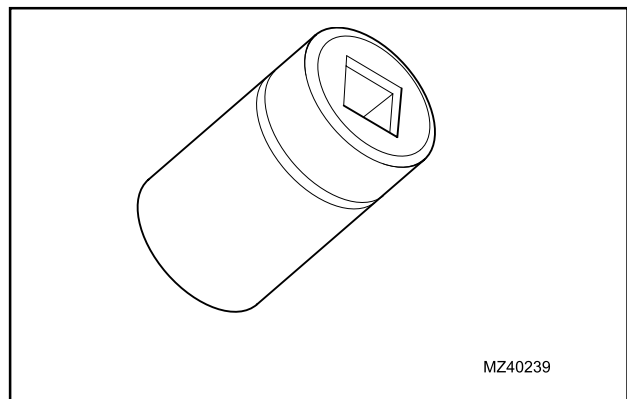
Oil seal driver
CA119143



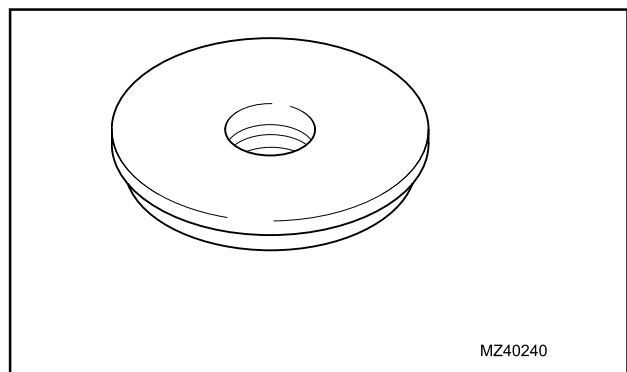
Driver for bearing
CA119230



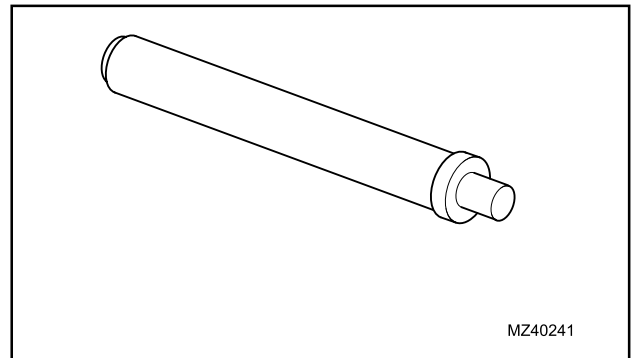
Pinion shaft lock wrench
CA715022



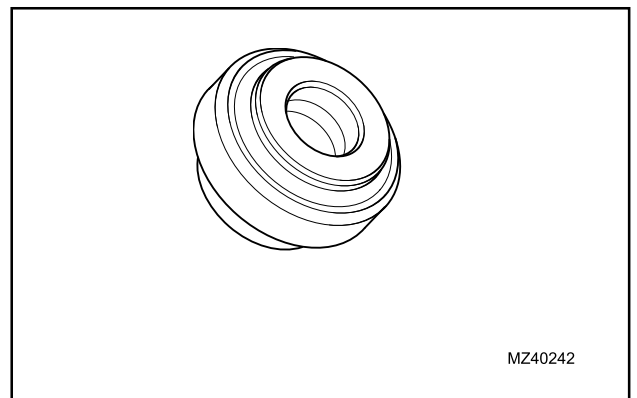
Bearing cone driver
CA715026



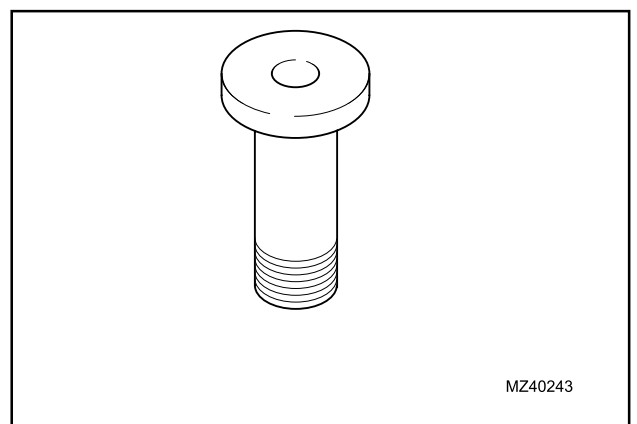
Bush wrench
CA715027



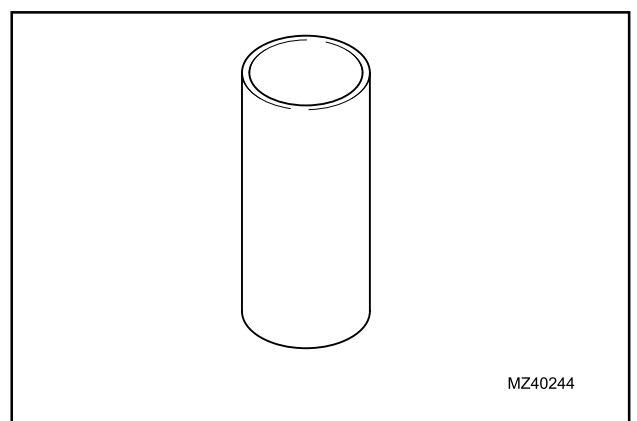
Bush driver
CA715039



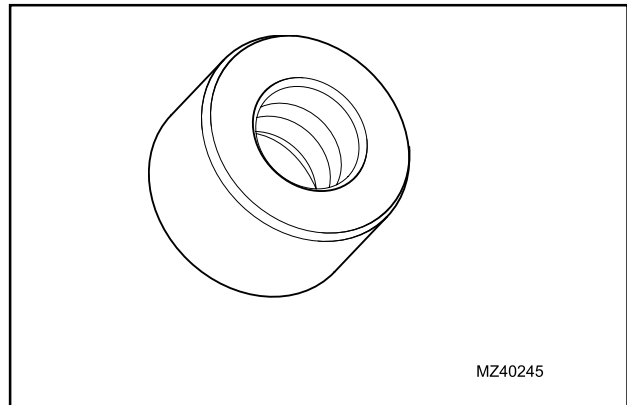
Dummy pinion
CA715040



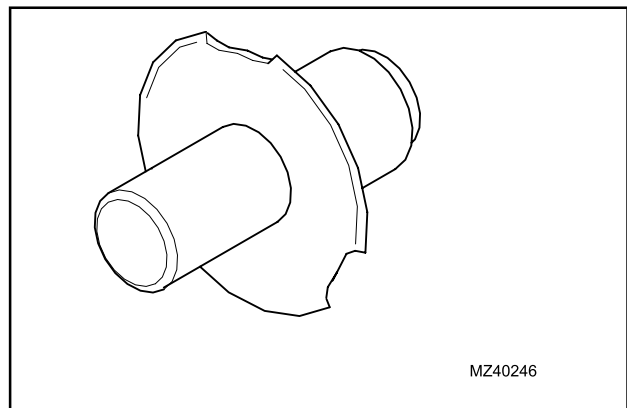
False differential box
CA715041



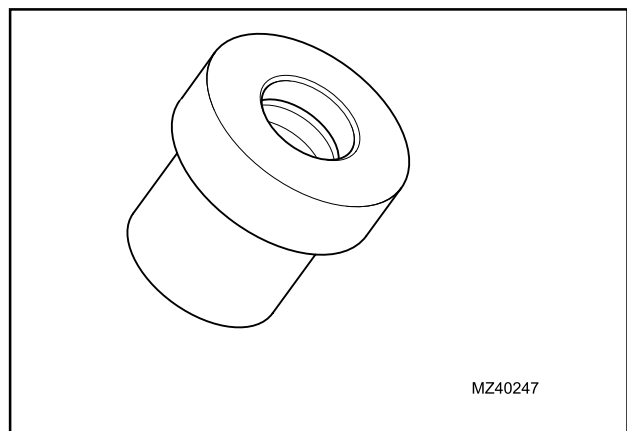
Driver for king pin bush
CA715042



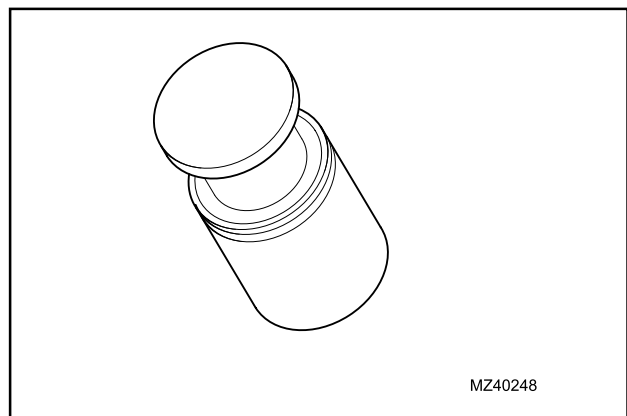
Driver for oil seal
CA715056



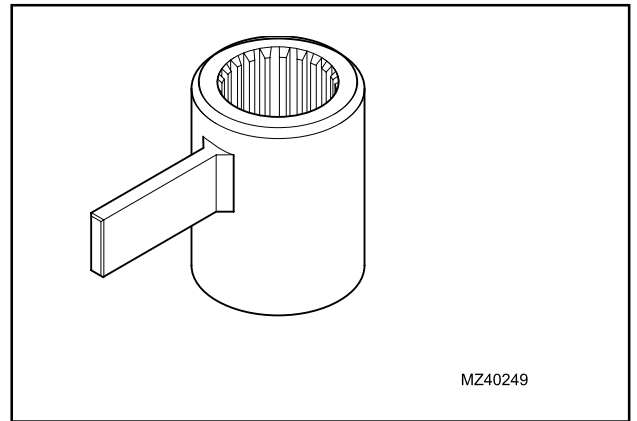
Bush driver
CA715108



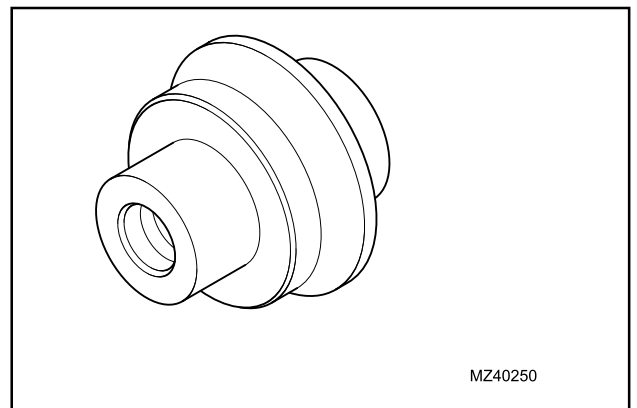
Extension for preload measurement
CA715116



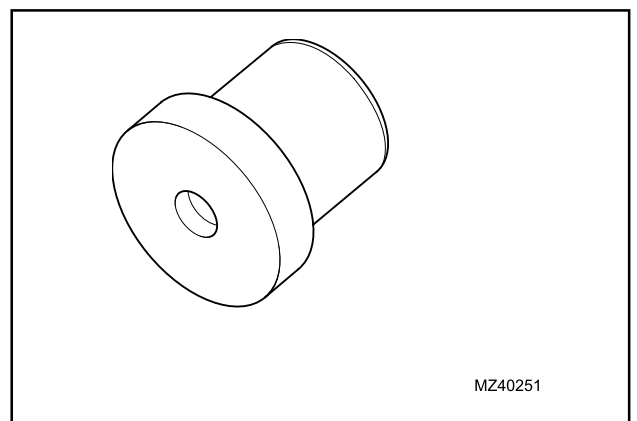
Kit for backlash measurement
CA715146



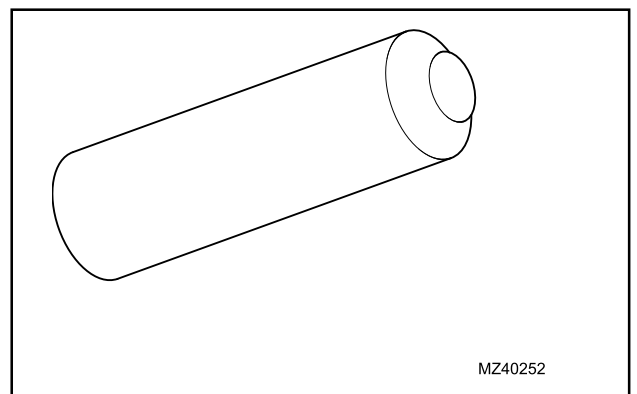
Oil seal driver
CA715156



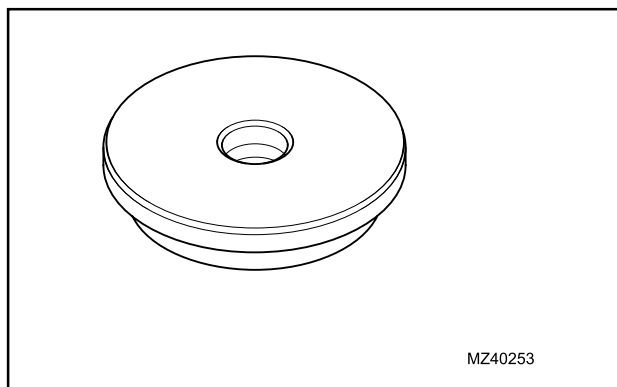
Bush driver
CA715157



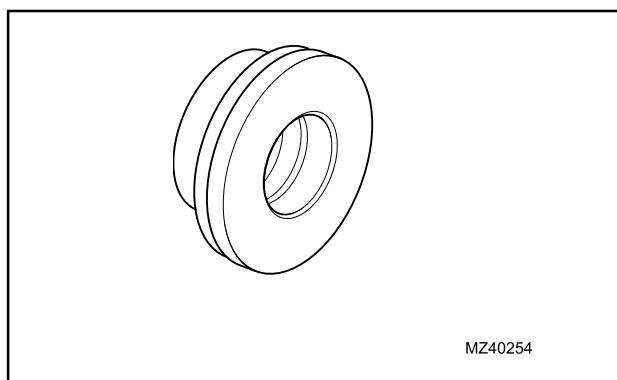
Bearing cone driver
CA715179



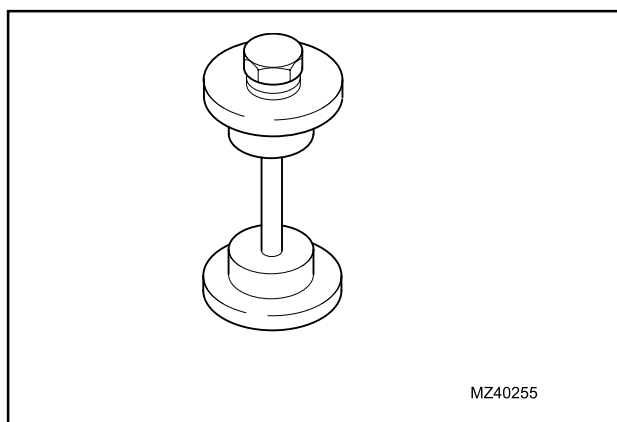
Bearing cup driver
CA715299



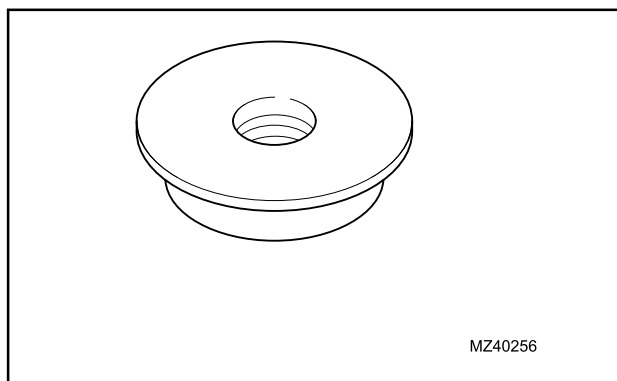
Driver for oil seal
CA715321



Bearing races insertion tool
CA715401



Driver for oil seal
CA715402



Toe-in adjustment

NOTE: The two bars must be fixed in the middle so that they are perpendicular to the supporting surface and parallel to the pinion shaft axis.

1. Fit a 1 metre bar on the wheel side of each hub and secure with a wheel nut. Make sure the centre of the bar is at the centre of the hub and the two bars are aligned.

NOTE: The tape measure should be tensioned evenly when taking measurements.

2. Measure the distance in mm (**M**) between the bars, at both front and rear of the axle, with a suitable tape measure.

3. Compare the difference between the two measurements and make sure toe-in is within the required tolerance range.

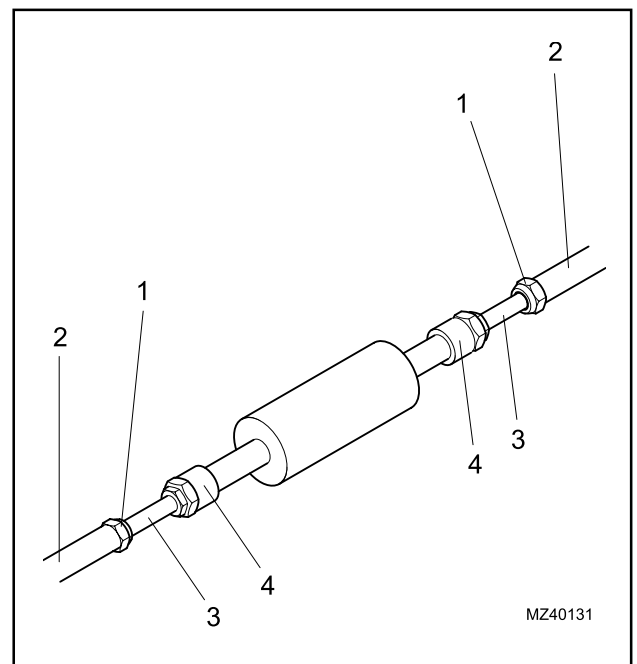
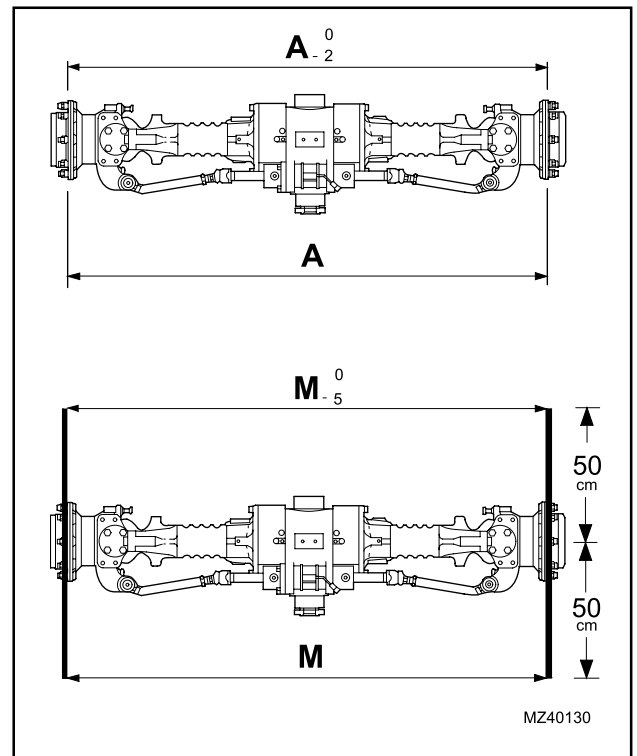
4. The normal toe-in value (**A**) is referred to the external diameter of the wheel hub flange, therefore the measured value (**M**) at the bar ends must be related to the ratio between length of the bar and flange diameter.

$$\text{Nominal toe-in} = A \frac{0}{-2}$$

$$\text{Measured toe-in} = M \frac{0}{-5}$$

5. If the toe-in is out of adjustment, loosen the lock nuts (1) on the track rods (2) and, using two wrenches, adjust the length of the track rods by turning the adjusters (3) on the ball joints (4) equally using two wrenches. Recheck the toe-in and adjust the track rods again if necessary. When toe-in is correct tighten the track rod lock nuts (1). Torque load nuts to 250 Nm (184 lbf ft.).

6. With the steering central, adjust the inductive magnetic steering sensor on the steering cylinder and secure with the locking clamps.

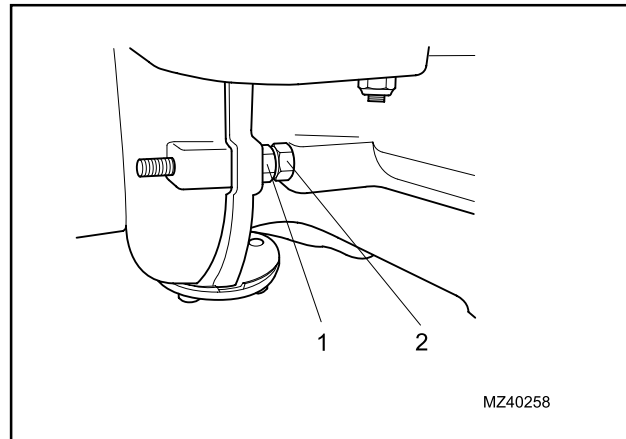


1. Lock nut
2. Track rod
3. Adjuster
4. Ball joint

Steering angle adjustment

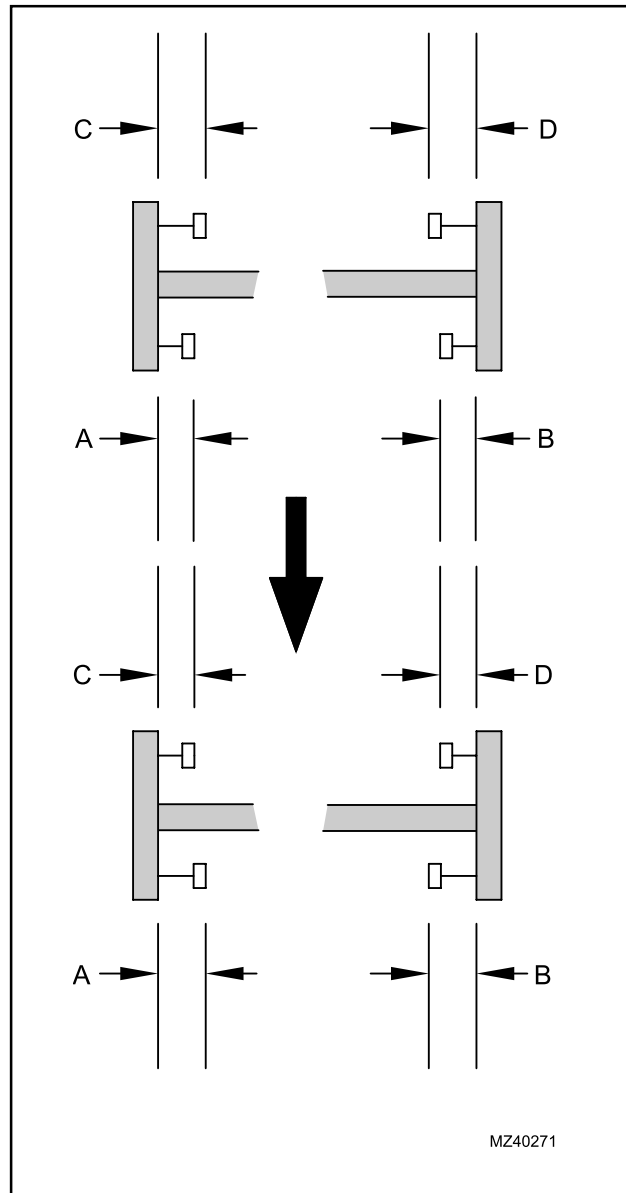
The steering angle on all hubs is set by adjusting the length of the adjuster, between the hub and the head of the adjuster, to the dimensions given in the Table.

1. Loosen lock nut (1) on all four adjusters of the front and rear axles and screw adjusters (2) inwards.
2. Set the adjuster bolt on each of the hubs of the front and rear axles as detailed in the Table, then tighten the lock nuts
3. Torque load all lock nuts to 100 Nm (74 lbf ft.).



1. Lock nut
2. Adjuster

AXLE	POSITION	DIMENSION
FRONT	A	45 mm
FRONT	B	45 mm
FRONT	C	30 mm
FRONT	D	30 mm
REAR	A	30 mm
REAR	B	30 mm
REAR	C	45 mm
REAR	D	45 mm



Rear axle pivots

Removal

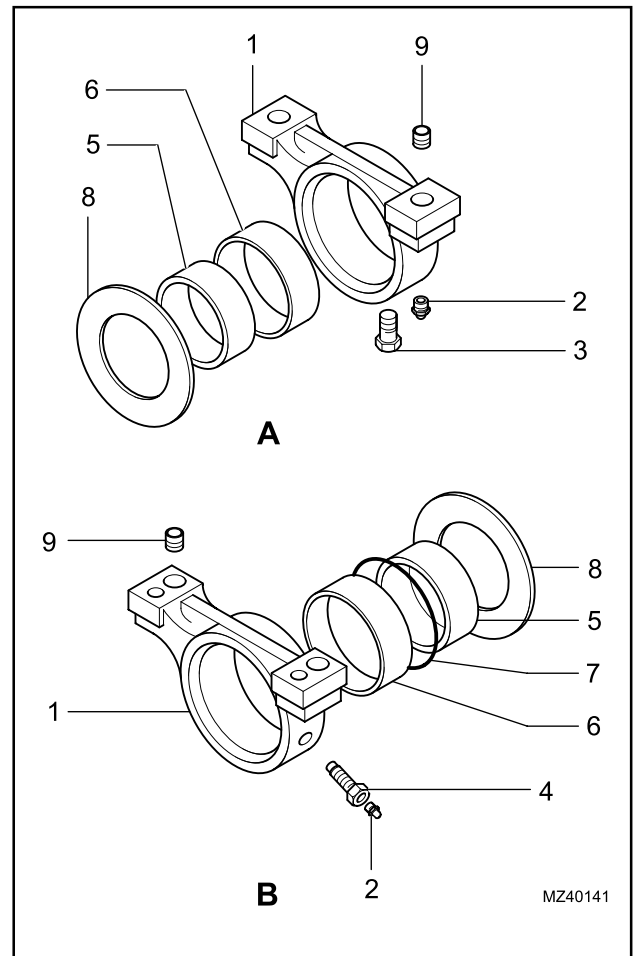
NOTE: This operation is to be carried out with the axle removed.

1. Remove the front and rear pivots (1) from the axle housing.
2. Remove the grease nipples (2) and bolts (3 & 4) from the front and rear pivots.
3. Press the inner and outer bushes (5 & 6) out of the front and rear pivots.
4. Remove the O-ring (7) the front pivot.
5. Remove the front and rear thrust washers (8) from the axle housing.
6. Remove the bushes (9) from the front and rear pivots.
7. Inspect all components for signs of wear and damage, replace as necessary.

Installation

1. Installation is reverse of the above procedure.
2. Fit a new O-ring to the front pivot.
3. Lubricate the pivots after assembly to the axle housing.
4. Torque load components as follows:

Bush retaining bolts 84 Nm (62 lbf ft.).



1. Pivot
2. Grease nipple
3. Bolt
4. Bolt
5. Inner bush
6. Outer bush
7. O-ring
8. Thrust washer
9. Bush

- A** Rear pivot
B Front pivot

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Testing after installation

After the axle has been installed to the machine, test the operation of the differential as follows:

1. Make sure the engine is switched off.
2. Lift the machine so that the wheels on the axle being tested are clear of the ground. The wheels of the axle not being tested must be in contact with the ground to stop the wheels turning.
3. With the assistance of a second person, rotate both wheels in a forward direction as far as possible (both the wheels should stop after a while).
4. Rotate the left wheel in the forward direction of travel and the right wheel in the rearward direction of travel. The wheels should both move freely without difficulty when the axle has been assembled correctly.
5. Repeat the above test while turning the wheels in the opposite direction.

WARNING



If the wheels do not rotate freely in both directions, the axle assembly is not correct and must be re-checked.

Troubleshooting

Operating problems

The following information is given as a guide to Operating problems and possible causes.

Problems	Possible Causes										
	1	2	3	4	5	6	7	8	9	10	11
Wheel vibration; front tyre resistance; halfshaft breakage	*	*	*		*						*
Steering is difficult; vehicle goes straight while it is turning	*	*	*	*							*
No differential action; jamming while steering	*			*	*						*
Excessive transmission noise	*	*	*	*	*		*		*		*
Uneven tyre wear	*	*	*	*	*	*	*				*
Friction noise	*			*	*			*	*	*	*
Vibration during forward drive, intermittent noise	*	*	*		*						*

Key to Operating problems table

1. Incorrect installation/defective axle

Correct installation or repair or replace the differential in case it does not survive any one of the test phases.

2. Overloading/incorrect weight distribution

Remove excessive weight and redistribute load, following instructions related to the machine.

3. Different rotation radius of the tyres

If one tyre has a smaller radius, it will cause partial wheel slipping when force is applied. The other tyre with larger radius will have to support all the work. Replace the tyre or adjust pressure to have same radius on both tyres.

4. Broken halfshaft

It is not advisable to operate the machine with a broken halfshaft. It is acceptable to move the machine (engine off loaded) a few metres only.

5. Bent halfshaft

Replace halfshaft.

6. Blocked differential

Abnormal functioning of the differential or breakage/blockage of command device. Verify assembly and all components.

Machines with wide steering angles may proceed with kicks, have steering difficulty or cause tyre wearing on sharp turns. Reduce the steering angle to minimum and decelerate the machine when the steering begins to kick.

7. Incorrect wheel adjustment

Check group integrity and wheel side bearings. Adjust accordingly.

8. Spoiled or worn out axle parts

Check the condition of the ring gear, pinion gear, bearings etc. Replace components as necessary.

9. Contamination in the axle box or incorrect assembly of parts

Look for foreign particles. Check the assembly of the axle components.

10. Incorrect adjustment of bevel gear set: Parts of the transmission worn out

Replace or adjust as required (transmission gears, U joints etc.).

11. Incorrect use of the product

Refer to the machine manufactures instructions.

Axle problems

The following table gives a description of common axle problems, the cause and repair action to correct the problem.

Problem	Cause	Action
Ring gear tooth broken at the outer side	1. Excessive gear load compared to the one forseen. 2. Incorrect gear adjustment (excessive backlash). 3. Pinion nut loose.	Replace bevel gear set. Follow carefully the recommended operations for the adjustment of bevel gear and backlash.
Ring gear tooth broken side	1. Load bump. 2. Incorrect gear adjustment (insufficient backlash). 3. Pinion nut loose.	Replace bevel gear set. Follow carefully the recommended operations for the adjustment of bevel gear and backlash. Use correct lubricants, fill to the correct level and replace at correct intervals.
Overheated ring and pinion teeth. See if gear teeth have faded.	1. Prolonged functioning at high temperatures. 2. Incorrect lubrication. 3. Low oil level. 4. Contaminated oil.	Replace bevel gear set. Use correct lubricants, fill to the correct level and replace at correct intervals.
Pinion teeth pitting	1. Excessive use. 2. Insufficient lubrication.	Replace bevel gear set. Use correct lubricants, fill to the correct level and replace at correct intervals.
Axle beam body bent	1. Machine overloaded. 2. Machine accident. 3. Load bump.	Replace axle beam body.
Worn out or pitted bearings	1. Insufficient lubrication. 2. Contaminated oil. 3. Excessive use. 4. Normal wear. 5. Pinion nut loose.	Replace bearings. Use correct lubricants, fill to the correct level and replace at correct intervals.
Oil leakage from gaskets and seals	1. Prolonged functioning at high oil temperatures. 2. Oil gasket assembled incorrectly. 3. Seal lip damaged. 4. Contaminated oil.	Replace the gasket or seal and mating surface, if damaged. Use correct lubricants, fill to the correct level and replace at correct intervals.
Excessive wearing out of input flange spline	1. Exhaustive use. 2. Pinion nut loose. 3. Pinion axle backlash.	Replace the flange. Check that the pinion spline is not excessively worn. Replace bevel gear set if necessary.
Fatigue failure of pinion teeth. See if fracture line is well defined (wave lines, beach lines)	1. Exhaustive use. 2. Continuous overload.	Replace bevel gear set.
Pinion and ring gear breakage	1. Crash load of differential components.	Check and replace other differential components.
Side gear spline worn out. Replace all scratched washers (excessive backlash)	1. Excessive use.	Replace differential gear group. Replace halfshaft if necessary.
Thrust washer surface worn out or scratched	1. Insufficient lubrication. 2. Incorrect lubrication. 3. Contaminated oil.	Use correct lubricants, fill to the correct level and replace at correct intervals. Replace all scratched washers and those with 0.1 mm thickness less than the new washers.
Inner diameter of tapered roller bearing worn out	1. Excessive use. 2. Excessive pinion axial backlash. 3. Insufficient lubrication. 4. Contaminated oil.	Replace bearing. Check pinion axial backlash. Use correct lubricants, fill to the correct level and replace at correct intervals.
Bent or broken halfshaft	1. Machine intensively operated or overloaded.	Replace.
Halfshaft broken at wheel side	1. Wheel support loose. 2. Beam body bent.	Replace. Check that wheel support is not worn out or incorrectly adjusted.

Axle noise problems and diagnosis

The following table gives a description of axle noises problems, the cause and repair action to correct the problem.

Problem	Cause	Action
Noise while driving	1. Excessive backlash between pinion and ring gear. 2. Worn out pinion and gear ring. 3. Worn out pinion bearings. 4. Pinion bearings loose . 5. Excessive axial pinion backlash. 6. Worn out differential bearings. 7. Differential bearings loose. 8. Ring gear not coneconcentric. 9. Low lubricant level. 10. Bent halfshaft.	1. Adjust. 2. Replace. 3. Replace. 4. Adjust. 5. Adjust. 6. Replace. 7. Adjust. 8. Replace. 9. Replenish. 10. Replace.
Noise while driving in neutral	1. Noises coming from axle are usually heard when machine moves in neutral gear but are not loud. 2. Incorrect backlash between pinion and ring (sound heard while decelerating, disappears while accelerating). 3. Pinion or input flange worn out.	1. Replace or adjust (see above). 2. Replace. 3. Replace.
Intermittent noise	1. Ring gear damaged . 2. Differential box bolts loose.	1. Replace bevel gear set. 2. Tighten to correct torque load.
Constant noise	1. Ring gear teeth or pinion damaged. 2. Worn out bearings. 3. Pinion spline worn out. 4. Bent halfshaft.	1. Replace bevel gear set. 2. Replace. 3. Replace. 4. Replace.
Noise while steering	1. Worn out differential gears. 2. Worn out differential box or spider. 3. Differential thrust washer worn out. 4. Halfshaft spline worn out.	1. Replace. 2. Replace. 3. Replace. 4. Replace.

Steering

Description

The steering system is fully hydrostatic. This means that the steering motion is transmitted hydraulically with no mechanical linkage between the steering wheel and the steered wheels. The hydraulic supply is by a dynamic system working with a load-sensing (LS) pump. Pump supply passes through a priority valve and generates a load-sensing signal.

Operation

The OSPF steering unit interfaces the steering valve with an adapter. Depending on the steering mode selected in the cab, (two-wheel steer, four-wheel steer or crab steer), the selector valve directs oil to the selected steering cylinder when input is made from the steering wheel.

In the neutral position, oil is allowed to flow freely from the priority valve through the steering unit to return (LS to T). As the steering wheel is turned the spools of the valve rotate against each other and proportionally direct oil to the selected steering cylinder. Not until the rotary valve is fully open is the LS connection to the tank fully closed.

A pressure relief valve is fitted in the steering unit. If the pressure rises above 175 bar (2537 psi), the PRV will open and return excess pressure to tank.

Shock valves are fitted to in the steering unit to protect the cylinders and hoses and are set at a higher pressure than the PRV.

When hydraulic pressure fails, the vehicle can be steered manually. The steering wheel, when turned, drives the outer spool with the cross pin and the rotor is turned by the cardan shaft which acts as a manual pump to supply oil to the steering cylinder. In this case the steering effort required will be increased significantly.

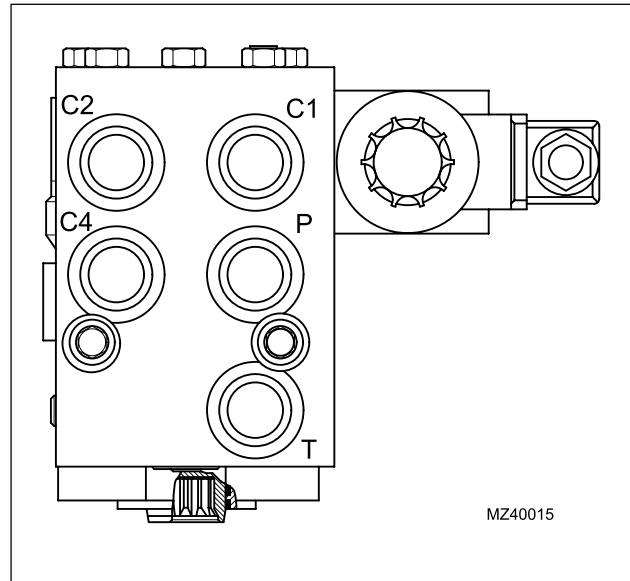
Specification

Type OSPF250LS

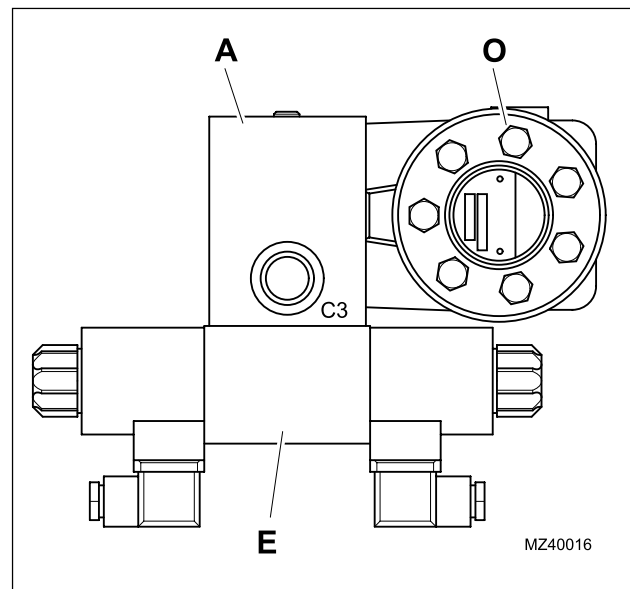
PRV 170-175 bar (2465-2537 psi)

Shock valve 225-245 bar (3262-3552 psi)

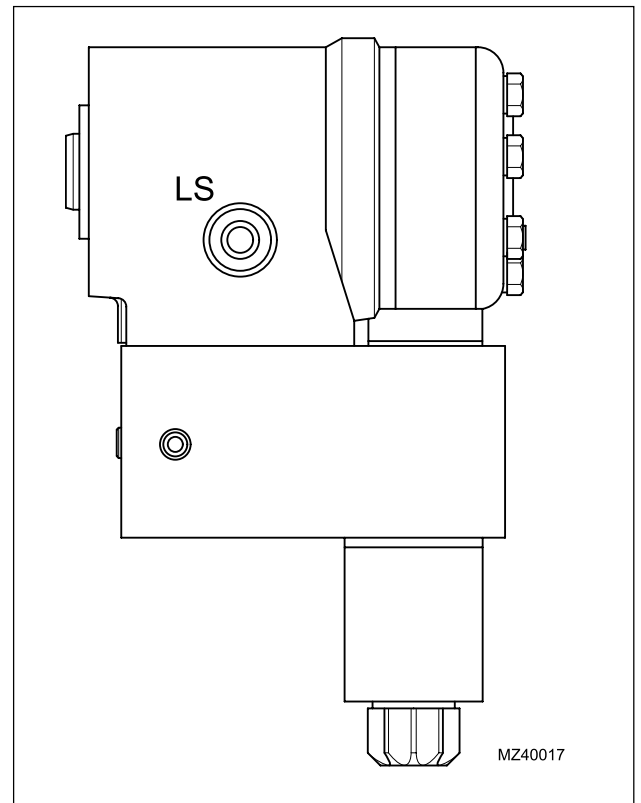
Displacement 250 cu.cm/rev



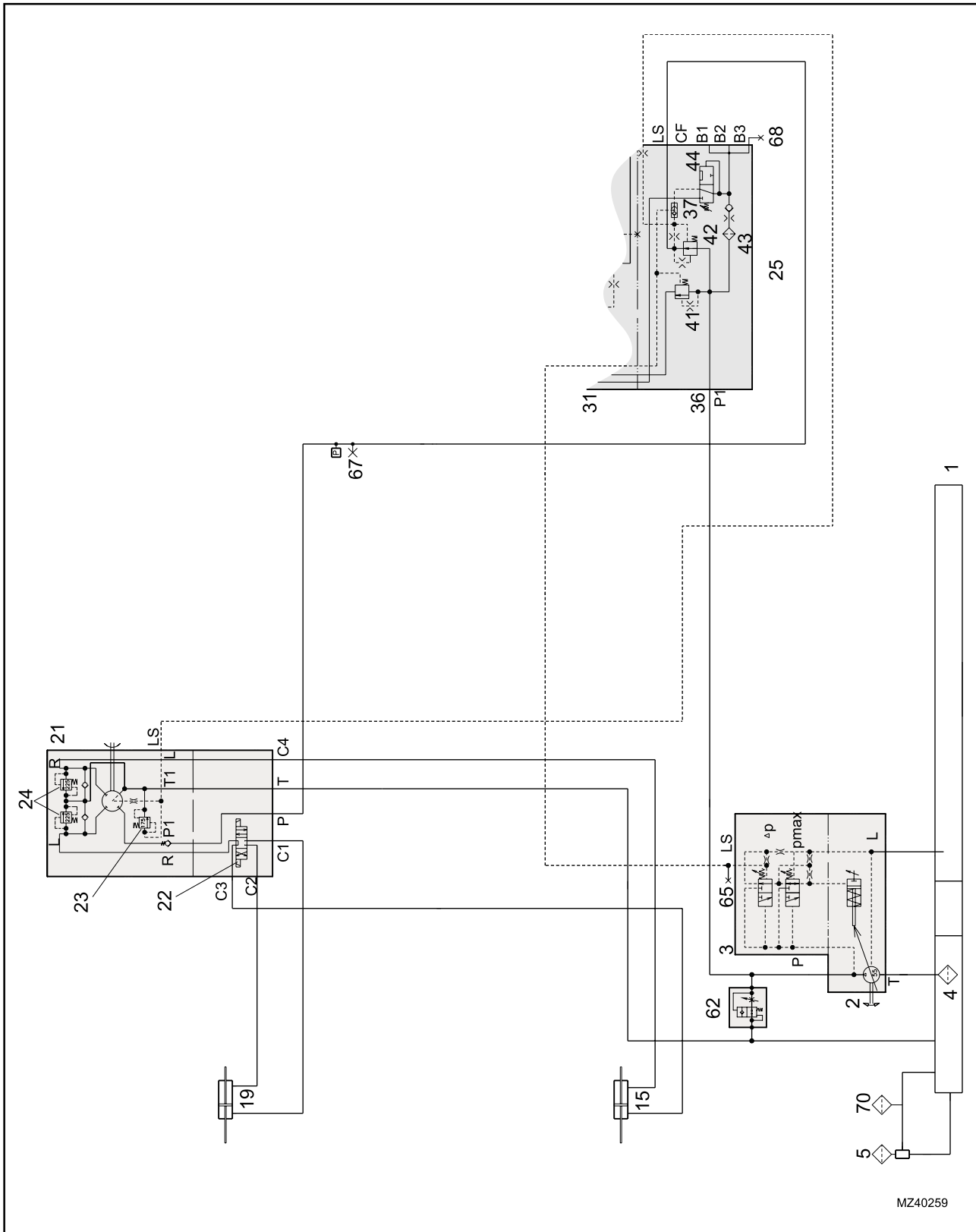
- C1 To rear cylinder
- C2 To rear cylinder
- C4 To front cylinder
- P Pressure from LS – pump
- T Tank



- C3 To front cylinder
- O OSPF250 valve (21)
- A Adapter
- E Selector valve (22)



LS LS – line



2. Hydraulic pump, load sensing
3. LS pump compensator
15. Steering cylinder, front
19. Steering cylinder, rear
22. Steering selector valve
23. Pressure relief valve, 175 bar
24. Shock valve, 225 - 245 bar

- 25. Control valve PVG 32
- 36. PVSP, inlet section
- 41. Priority valve, brakes and steering
- 42. Priority valve, steering
- 62. Start-up valve (from Machines S/No.51200472 only)
- 65. Test point (main system pressure LS)

Checking the steering system**Steering cylinder**

1. Raise and securely support the front axle.
2. Turn steering fully to left.
3. Disconnect hose from adapter on right hand end of cylinder
4. Start the engine and operate steering wheel fully left to apply maximum hydraulic pressure to cylinder. Make sure no oil flows from open right hand connection.
5. Stop engine, connect hose to right hand hose to adapter and repeat above check on left hand side of cylinder.
6. Repeat all above checks on rear axle steering cylinder.
7. Start engine and bleed the hydraulic lines free of air.

Steering unit (OSPF)

Start the engine and run until oil is at normal operating temperature and any air is purged from system. Set engine at maximum rev/min, turn the steering wheel until the steering stops make contact. If the steering wheel can be turned without significant effort or the wheel turns on it's own, the rotor, spool or shock valves are faulty and the steering unit must be replaced.

Servicing

Servicing is normally limited to the replacement of the three main components (steering unit, adapter and steering valve) and the seals between these components.

The steering cylinders can also be overhauled. For overhaul of the steering cylinder, refer to the Hydraulic Manual.

Steering valve assembly (22)**Removal**

1. Stop the engine and chock the machine, apply the parking brake.
2. Refer to page 1.53 and dump hydraulic pressure then disconnect the battery.
3. Remove the front cover from outside of the cab.
4. Make sure the steering valve assembly is free from dirt to avoid contamination of the hydraulic system.
5. Identify and label the electrical connectors on the steering valve. Disconnect the electrical connectors and fit blanks to the connectors and valve.
6. Position a suitable container under the steering valve assembly to collect any oil spillage during removal.
7. Identify and label the hydraulic hoses. Disconnect all hoses from the steering valve assembly and blank open connections on valve and hoses. Tie hoses clear of valve.
8. From inside the cab, remove the nut, washer, three bolts and washers securing the valve to the steering column. Remove the valve from the machine by disconnecting the splined drive.

Installation

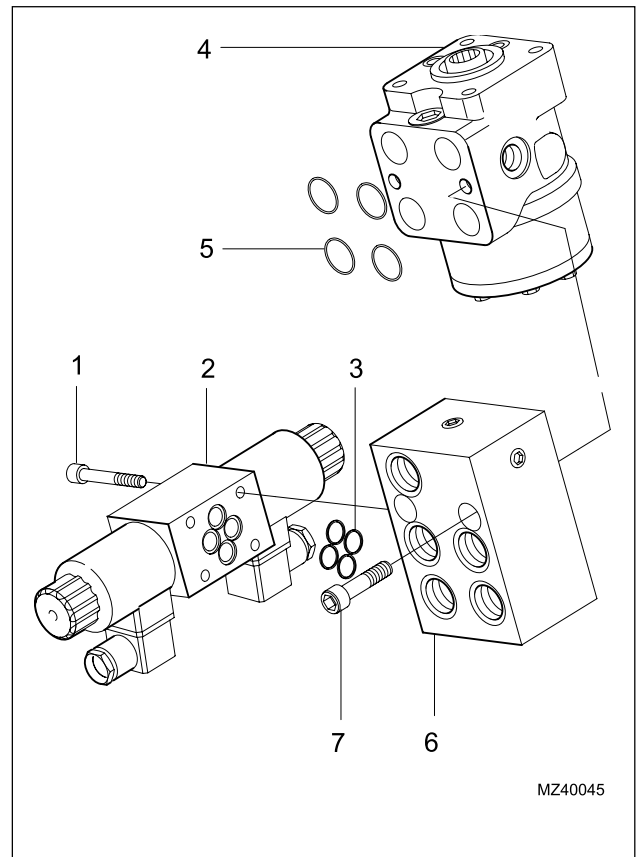
1. Installation is the reverse of the above procedure.
2. Make sure all hoses and electrical connectors are connected to the correct service.
3. Refer to page 1.54, check the hydraulic tank level and replenish before the engine is started.
4. Purge the hydraulic system by starting the engine and operating the steering to fully extend and retract front and rear steering cylinders several times.
5. Refer to Page 1.54, check the hydraulic level and replenish if necessary.
6. Check the steering operates correctly in all modes, (two-wheel steer, four-wheel steer and crab steer).

Dismantling

1. Remove the four cap head screws (1) attaching the steering valve (2) to the adapter (6). Remove and discard the O-ring seals (3).
2. Remove the two cap head screws (7) attaching the adapter (6) to the steering unit (4). Remove and discard the O-ring seals (5).
3. Examine the steering valve for damage to the block or solenoids and electrical connectors. If any damage is found, the valve must be replaced as a unit.
4. Examine the adapter for damage to the block. If any damage is found, the adapter must be replaced.
5. Examine the steering unit for damage to the block. If any damage is found, the unit must be replaced.

Assembly

1. Assemble the steering valve assembly in the reverse order to dismantling.
2. Use new O-rings during assembly.
3. Tighten the screws progressively in rotation.



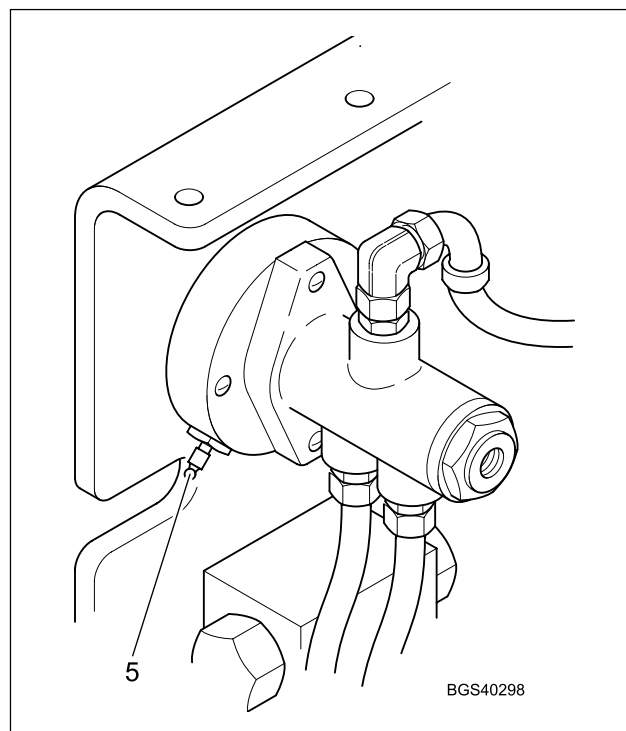
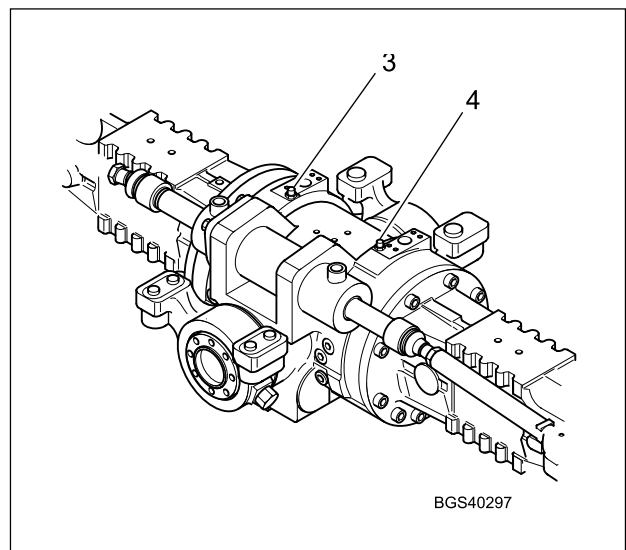
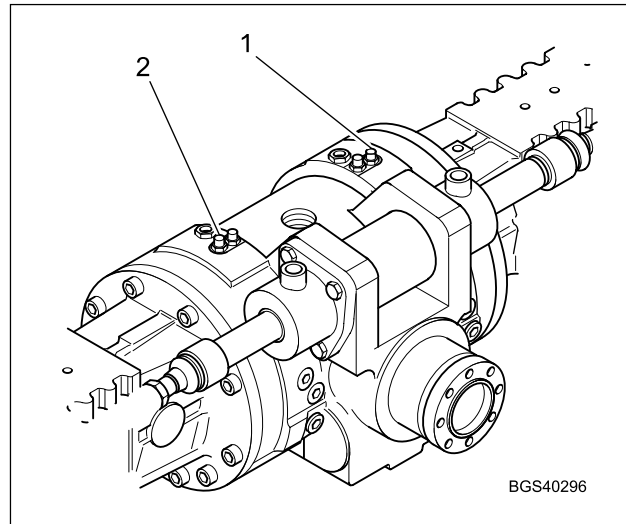
1. Cap head screw – M5 x 45
2. Steering valve
3. O-ring
4. Steering unit
5. O-ring
6. Adapter
7. Cap head screw – M10 x 46

Brake system - bleeding brake system pressure

General

Bleed the brake system after a brake system component change and when air in the system is suspected. Air in the system will not allow the brakes to release properly and may cause damage.

1. Start the engine and allow the accumulator to fully charge.
2. Stop the engine. Slowly apply and release brakes until they will not apply, waiting for one minute between applications. Repeat this operation three times.
3. Start the engine and allow the accumulator to fully charge then stop the engine. Operate the engine as necessary to maintain accumulator at working pressure throughout the bleeding procedure.
4. Attach a bleed tube to the bleed screw (1) on the brake unit nearest to the brake valve (front right) and put the bleed tube into a suitable container. Carefully open bleed screw (1), apply brakes until all air is bled out of line then close bleed screw (1) and remove bleed tube. Bleed the other brake units and the trailer brake valve in the order that follows:
 - A. Front left (2)
 - B. Rear right (3)
 - C. Rear left (4)
 - D. Trailer brake valve (5)
5. Release brake pressure for at least one minute.
6. Apply brakes, hold pedal down for ten seconds then release pressure for one minute. Repeat this operation two more times.
7. Bleed the brakes one more time.
8. Check the system components and brake lines for leaks.



Dissipation (dumping) of hydraulic pressure**WARNING**

Always dump all hydraulic pressure from the system before servicing any hydraulic component.

WARNING

Ensure there is sufficient space and headroom around machine before operating any hydraulic control.

To dump brake system pressure

1. Stop the engine.
2. Make sure the machine is parked on firm and level ground and chock the wheels.
3. Turn the ignition switch to position **(1)**.
4. Set the parking brake switch, if necessary, to the parking brake applied position.
5. Press the brake pedal repeatedly until the brake charge warning lamp illuminates.
6. Press the brake pedal a further twenty times to ensure that residual pressure in the brake system is fully dissipated.
7. Turn the ignition switch to off.

To dump a system pressure

NOTE: This procedure applies to all machine hydraulic systems, except brakes.

1. Stop the engine.
2. Make sure the machine is parked on firm and level ground and chock the wheels.
3. Turn the ignition switch to position 'I'.
3. Operate the applicable system until all hydraulic pressure has been dissipated.
4. Turn the ignition switch to off.

WARNING *Fine jets of hydraulic fluid at high pressure can penetrate the skin. Do not use your fingers to check for hydraulic fluid leaks. Do not put your face close to suspected leaks. If hydraulic fluid penetrates your skin seek medical help immediately.*



Hydraulic level

Check

1. Position the machine on level ground.
2. Make sure all hydraulic cylinders are fully closed.
3. Stop the engine, apply the parking brake.
4. Open the engine pod cover.
5. Check hydraulic tank sightglass (2), make sure fluid level shows in sightglass and is above the red line.

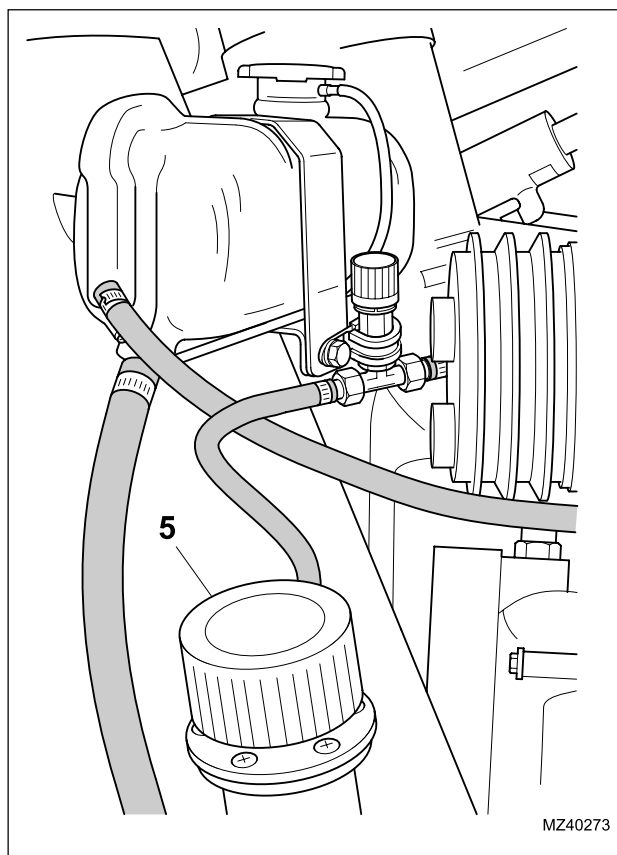
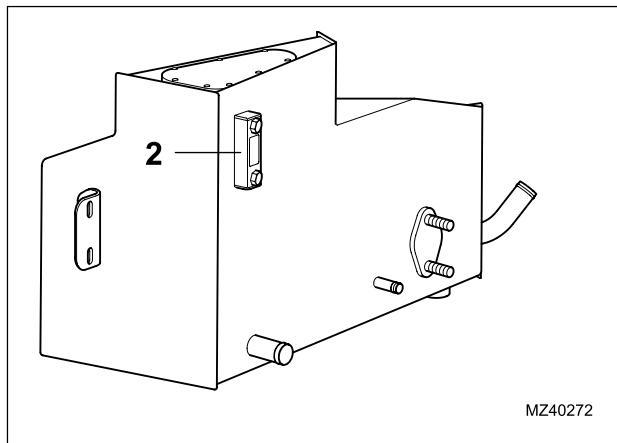
NOTE: Wait for two minutes, after engine is stopped, before checking fluid level.

6. Replenish fluid if necessary as follows:

WARNING *The cap maintains an air pressure of 0.3 bar in the hydraulic tank.*



7. Clean filler cap (1) and remove.
8. Top up hydraulic tank with fluid to correct level and refit filler cap.
9. Close engine pod cover.



1. Filler cap
2. Sightglass

SECTION 2

ENGINE

Description

The machine is fitted with a side mounted Perkins 1004.40T 4 litre turbocharged direct injection diesel engine. An optional higher power engine, the Perkins 1004.40TW, is a similar unit but with an air to water intercooler to cool the induction air between the turbocharger and the cylinders.

The engine cooling system is by a gear driven water pump on the engine and a side mounted radiator. The radiator is cooled by a fan, which is driven by a V-belt by a hydraulic motor. A thermostat controls the temperature of the coolant in the engine.

Fuel is supplied from a 200 litre tank, located below the cab, to a pre-filter (water separator) then a cartridge filter. The pre-filter has a drain tap fitted. The cartridge filter is a replaceable item, only use genuine Claas parts.

Induction air passes through a pre-cleaner (externally mounted) and then two filter elements. A filter blockage sensor is fitted to the air cleaner body and lights a warning indicator in the cab when the filter requires cleaning. The engine must not be operated when the warning indicator is illuminated.

The engine and gearbox should always be removed as an assembly either by leaving the engine pod in situ and removing the engine and gearbox from the machine or removing the engine pod then removing the engine and gearbox from the pod. The transmission can be removed separate to the engine but with some difficulty, and only after removing the engine pod.

For specific engine tests, refer to the Perkins Engine Manual.

Engine Data

Engine	K50	K60	K70
Perkins 1004.40T	78.5kW (106 PS)	78.5kW (106 PS)	78.5kW (106 PS)
Net output	394 Nm @ 1.400 rpm	394 Nm @ 1.400 rpm	394 Nm @ 1.400 rpm
Perkins 1004.40TW (Option)	91.0kW (122 PS)	91.0kW (122 PS)	91.0kW (122 PS)
Net output	434 Nm @ 1,500 rpm	434 Nm @ 1,500 rpm	434 Nm @ 1,500 rpm
NOTE: Perkins 1004.40TW option has an intercooler between turbocharger and engine.			

REMOVAL AND INSTALLATION

General

The engine is usually removed complete with gearbox and can be removed as a complete unit with the pod or the pod can be left attached to the machine. Both methods of removal are described.

Removal (complete with pod)

1. Park the machine on a firm level surface. Apply the parking brake and chock the wheels.
2. Stop the engine
3. Refer to Page 1.53 and dump the hydraulic pressure.
4. Open the engine cover, disconnect the two gas struts and remove the bolts securing the hinges to the engine cover. Remove the engine cover from the machine.
5. Disconnect the battery.

NOTE: Identify and label all hoses and electrical connectors before removal. Tie back all hoses and electrical cables to make sure they are not damaged during engine removal.

CAUTION *Do not drain the coolant until the engine is cold.*



6. Drain the engine cooling system.
7. Disconnect the inlet and outlet coolant hoses from the cab heater. Tie the hoses clear of the pod.
8. Recover the gas from the air conditioning system (if fitted) using suitable equipment.
9. Disconnect the air conditioning system compressor hoses and fit blanks to the compressor and hoses (if fitted). Tie the hoses clear of the pod.
10. Disconnect the hydraulic hoses from the auxiliary hydraulic pump. Fit blanks to the pump and hoses. Tie the hoses clear of the pod.
11. Disconnect the starter motor and starter solenoid electrical cables.
12. Disconnect the main earth cable.

13. Disconnect the fuel supply and fit blanks to the engine and fuel hoses. Tie the hoses clear of the pod.
14. Remove the front drive shaft.
15. Disconnect the rear drive shaft from the transfer gearbox.
16. Remove the hose connections from the rear of the main hydraulic pump.
17. Disconnect all the electrical connections from the engine harness to the cab, pull the harness through into the engine pod and secure.
18. Disconnect all the engine pod electrical loom connectors to the front and rear of the engine. Tie the cables clear of the pod.
19. Disconnect the accelerator cable from the engine and pull through to the centre of the chassis.
20. Disconnect the air cleaner to engine hose. Remove the air cleaner assembly, including pre-cleaner, from the machine. Remove the air cleaner support panel.
21. Disconnect and remove the flexible exhaust pipe between the engine and silencer. Remove the silencer.
22. Support the pod using a suitable fork-lift under the pod or fit a suitable lifting sling to the engine pod and attach to a suitable overhead lifting device.

WARNING *The engine and transmission assembly complete with pod is heavy, take care during removal.*



CAUTION *During removal make sure engine and chassis components are not damaged. Make sure all hoses, electrical cables and controls are disconnected.*



23. Remove the four mounting bolts securing engine pod to chassis.
24. Remove the engine and transmission complete with pod from the chassis. Place the unit on a suitable work stand.

Installation

1. Installation is the reverse of the above procedure, however pay particular attention to the following:
2. Make sure engine and chassis mounted components are not damaged during installation.
3. Make sure all electrical leads are connected to the correct components.
4. Secure wiring loom to engine/chassis.
5. Torque load the attachment bolts as follows:

Engine pod to chassis	640 Nm (472 lbf ft.)
Drive shaft to gearbox	61-81 Nm (45-60 lbf ft.)
Drive shaft to axle	70-85 Nm (52-63 lbf ft.).
6. Replenish the cooling system, hydraulic system (refer to Page 1.55), transmission and engine lubricating oil.
6. Charge the air conditioning system (if fitted) using suitable equipment.
8. Start engine and make sure all warning lights operate correctly.
9. Make sure all disturbed hoses and pipes do not leak.
10. Stop the engine and check the fluid levels of the cooling system, transmission, hydraulic system (refer to Page 1.54) and engine lubricating oil. Replenish as necessary.
11. Test the machine.

Testing

For specific engine tests, refer to the Perkins Engine Manual.

Removal (pod left on machine)

1. Park the machine on a firm level surface. Apply the parking brake and chock the wheels.
2. Stop the engine
3. Refer to Page 1.53 and dump the hydraulic pressure.
4. Open the engine cover, disconnect the two gas struts and remove the bolts securing the hinges to the engine cover. Remove the engine cover from the machine.
5. Disconnect the battery.

NOTE: Identify and label all hoses and electrical connectors before removal. Tie back all hoses and electrical cables to make sure they are not damaged during engine removal.

CAUTION *Do not drain the coolant until the engine is cold.*



6. Drain the engine cooling system.
7. Drain the transmission system oil.
8. Disconnect the inlet and outlet coolant hoses from the radiator. Disconnect the expansion tank hose from the radiator.
9. Disconnect the oil coolant hoses from the oil cooler.
10. Disconnect the hydraulic hoses from the fan hydraulic pump. Fit blanks to the pump and hoses.
11. Remove the radiator grille then the radiator, oil cooler and fan assembly.
12. Disconnect the starter motor and starter solenoid electrical cables.
13. Disconnect the alternator electrical cables and main earth cable.
14. Disconnect the fuel supply and fit blanks to the engine and fuel pipe.
15. Disconnect the air conditioning system compressor hoses and fit blanks to the compressor and hoses (if fitted).
16. Remove the front drive shaft.

17. Disconnect the rear drive shafts from the drop down box and tie clear of gearbox.

18. Disconnect the inlet and outlet hoses from the gearbox and fit suitable blanks to the gearbox and hoses.

19. Remove the hydraulic pump from the gearbox and support clear of gearbox.

20. Disconnect the speed sensor from the gearbox.

NOTE: Before disconnecting the solenoids, mark the wiring/plugs to prevent cross connections.

21. Disconnect the solenoid plugs from the APC connectors.

22. Disconnect the following:

- Air cleaner blocked cables
- Oil pressure sender cable
- Transmission dump
- Thermostat cable.

23. Unclip the wiring loom from the engine and tie clear of engine.

24. Disconnect the accelerator cable from the engine.

25. Disconnect the air cleaner to engine hose.
Remove the air cleaner assembly from the machine.

26. Disconnect and remove the flexible exhaust pipe between the engine and silencer. Remove the silencer.

27. Fit a suitable lifting sling to the engine and attach to a suitable overhead lifting device.

WARNING



The engine and transmission assembly is heavy take care during removal.

CAUTION



*During removal make sure the engine and chassis components are not damaged.
Make sure all hoses, electrical cables and controls are disconnected.*

28. Remove the four mounting bolts securing engine and transmission to chassis.

29. Lift the engine and transmission from the chassis. Place the unit on a suitable work stand.

Installation

1. Installation is the reverse of the above procedure, however pay particular attention to the following:
2. Make sure engine and chassis mounted components are not damaged during installation.
3. Make sure all electrical leads are connected to the correct components.
4. Secure wiring loom to engine.
5. Torque load the attachment bolts as follows:

Engine/transmission to chassis	80-120 Nm (59-88.5 lbf ft.)
Drive shaft to gearbox	61-81 Nm (45-60 lbf ft.)
Drive shaft to axle	70-85 Nm (52-63 lbf ft.)
6. Replenish the cooling system, hydraulic system (refer to Page 1.54), transmission and engine lubricating oil.
7. Charge the air conditioning system (if fitted) using suitable equipment.
8. Start engine and make sure all warning lights operate correctly.
9. Make sure all disturbed hoses and pipes do not leak.
10. Stop the engine and check the fluid levels of the cooling system, hydraulic system (refer to Page 1.55), transmission and engine lubricating oil. Replenish as necessary.
11. Test the machine.

Testing

For specific engine tests, refer to the Perkins Engine Manual.

SECTION 3

TRANSMISSION

DESCRIPTION

The transmission system consists of a torque converter, T12000 transmission and a drop box.

The torque converter connects the engine to the transmission. The drop box connects the transmission to the front and rear drive shafts.

The standard transmission has six forward gears and three reverse gears.

Gear selection with APC

The gears are instantaneously selected by the transmission module APC (Automatic Powershift Controller). The higher forward gears (F4, F5 and F6) are selected automatically by the APC.

A kickdown function is available by pressing the button on the end of the gear selector lever, but is protected by the APC to prevent damage to the transmission. Reselect the original gear by pressing the button on the end of the gear selector lever.

Gear selection without APC (option)

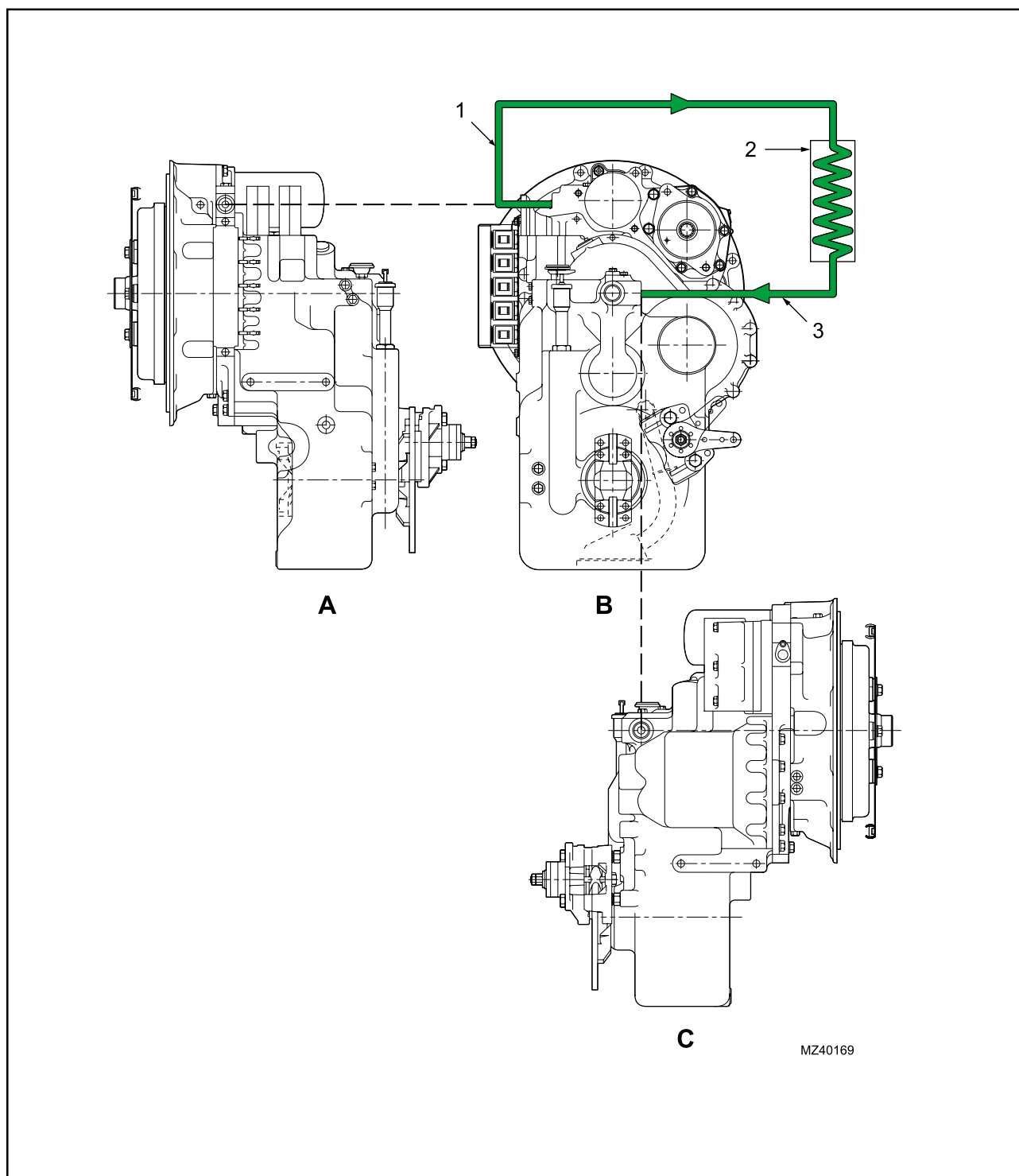
A gearbox selection option is available. This uses a non APC selector. The gearbox remains the same but the following are not available:

- Speed sensor
- Gearbox APC module
- Display menu in cab
- Kickdown
- Automatic switching.

Technical data

	K50	K60	K70
Gearbox Type	DANA T12000	DANA T12000	DANA T12000
Gear Selector	APC Powershift	APC Powershift	APC Powershift
STANDARD 40 km/h No of gears (Forward/Reverse)	6/3	6/3	6/3
OPTION 25 km/h No of gears (Forward/Reverse)	5/3	5/3	5/3
OPTION 20 km/h No of gears (Forward/Reverse)	4/2	4/2	4/2
Gear Selector	Non APC	Non APC	Non APC
OPTION 25 km/h No of gears (Forward/Reverse)	3/3	3/3	3/3
OPTION 40 km/h No of gears (Forward/Reverse)	4/3	4/3	4/3
Max Speed Standard	20 km/h	20 km/h	20 km/h
Max Speed Option	40 km/h	40 km/h	40 km/h
Weight with oil	175Kg	175Kg	175Kg
Oil Quantity	16 Litre	16 Litre	16 Litre
Torque Convertor Ratio	2.0:1	2.0:1	2.0:1
Gear Ratio in 1st Gear	4.24:1	4.24:1	4.24:1
Gear Ratio in 2st Gear	3.03:1	3.03:1	3.03:1
Gear Ratio in 3rd Gear	2.16:1	2.16:1	2.16:1
Gear Ratio in 4th Gear	1.54:1	1.54:1	1.54:1
Gear Ratio in 5th Gear	0.91:1	0.91:1	0.91:1
Gear Ratio in 6th Gear	0.65:1	0.65:1	0.65:1
Gearbox oil pump 50°C/2000min	50-53 l/min	50-53 l/min	50-53 l/min
Torque Convertor Pressure 50°C/2000min	6.5-8.0 bar	6.5-8.0 bar	6.5-8.0 bar
Torque Convertor Pressure Relief Valve	8.5-10 bar	8.5-10 bar	8.5-10 bar
System Pressure 50°C/2000min	16.5-19.5 bar	16.5-19.5 bar	16.5-19.5 bar
Lubrication Pressure 50°C/2000min	3.0-4.0 bar	3.0-4.0 bar	3.0-4.0 bar
4/2 Solenoid Voltage Resistance	12V/10W	12V/10W	12V/10W

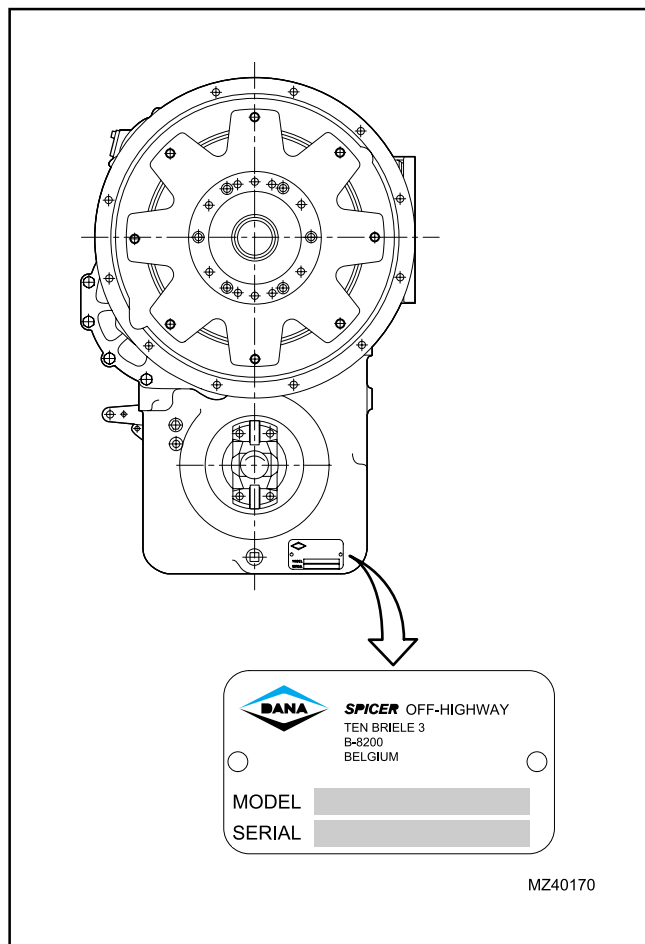
Gearbox layout (Typical - Shown without Transfer Gearbox)



- A Left view
- B Front view
- C Right view
- 1 From gearbox to oil cooler
- 2 Oil cooler
- 3 From oil cooler to gearbox

Gearbox type plate

For the Type, Serial No and the Model, refer to the plate on the gearbox.



Speed sensor

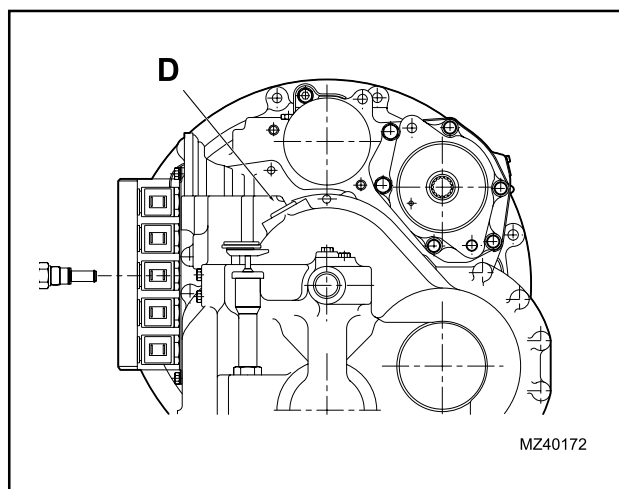
The speed sensor sends an impulse signal to the gearbox controller, in Hz, relating to gearbox speed

This signal is used for:

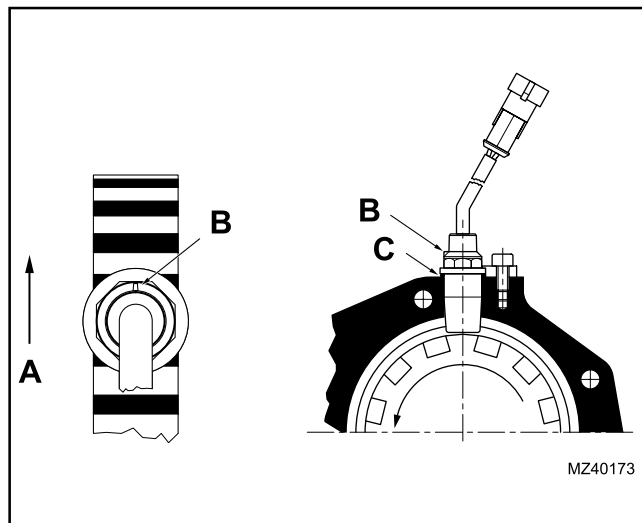
Controlling the speed at which gears can be changed

Controlling automatic gear change through 5th and 6th.

Controlling the speed at which a directional change can take place.

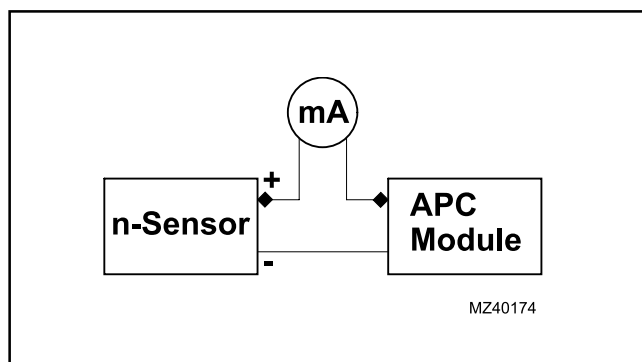


D Speed sensor

Speed sensor rotation

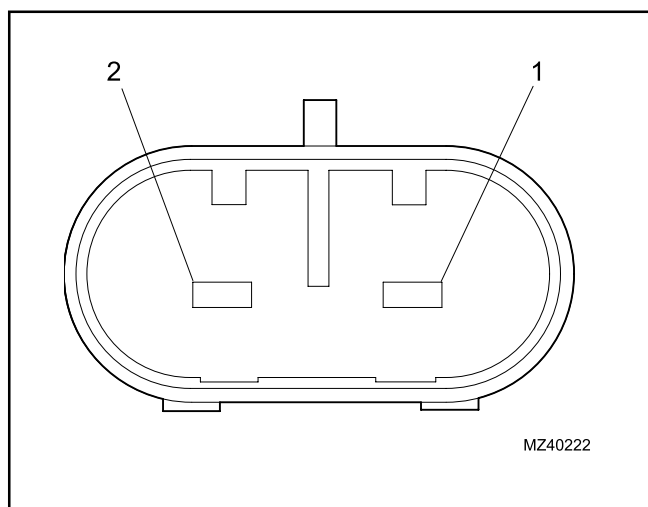
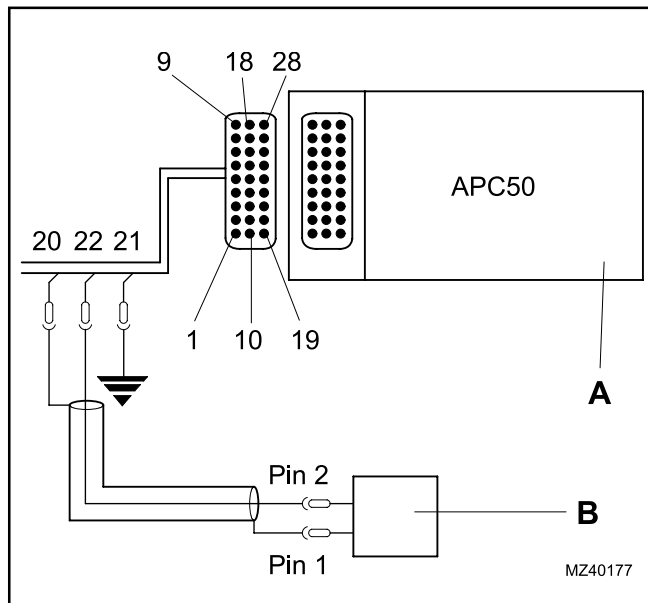
- A Direction of rotation
- B Mark (indicator) on sensor
- C O-Ring

The mark (B) on the side of the sensor must be in the direction of rotation (A).

Sensor test

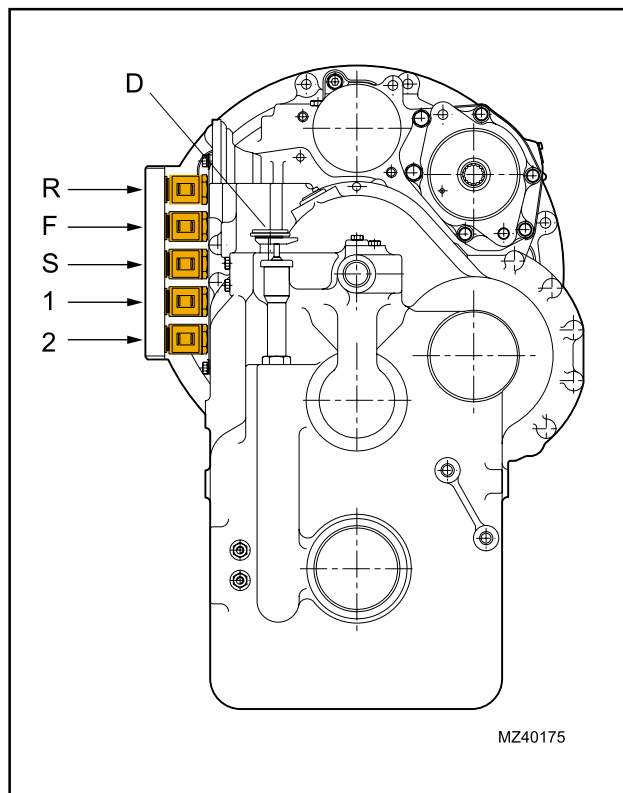
1. Connect multimeter in series between speed sensor and APC module, set multimeter to read mA.
2. Start machine.
3. The reading should be between 7 mA - 14 mA at tickover.
4. A reading of 60 mA indicates the wrong wire is being tested.
5. A reading of 20 mA indicates a short circuit.

Speed sensor to module connection



- A Module
- B Speed sensor
- Pin 1 Plus
- Pin 2 Minus
- 20 Speed sensor Input
- 21 Module ground
- 22 Speed sensor earth

Arrangement of solenoids

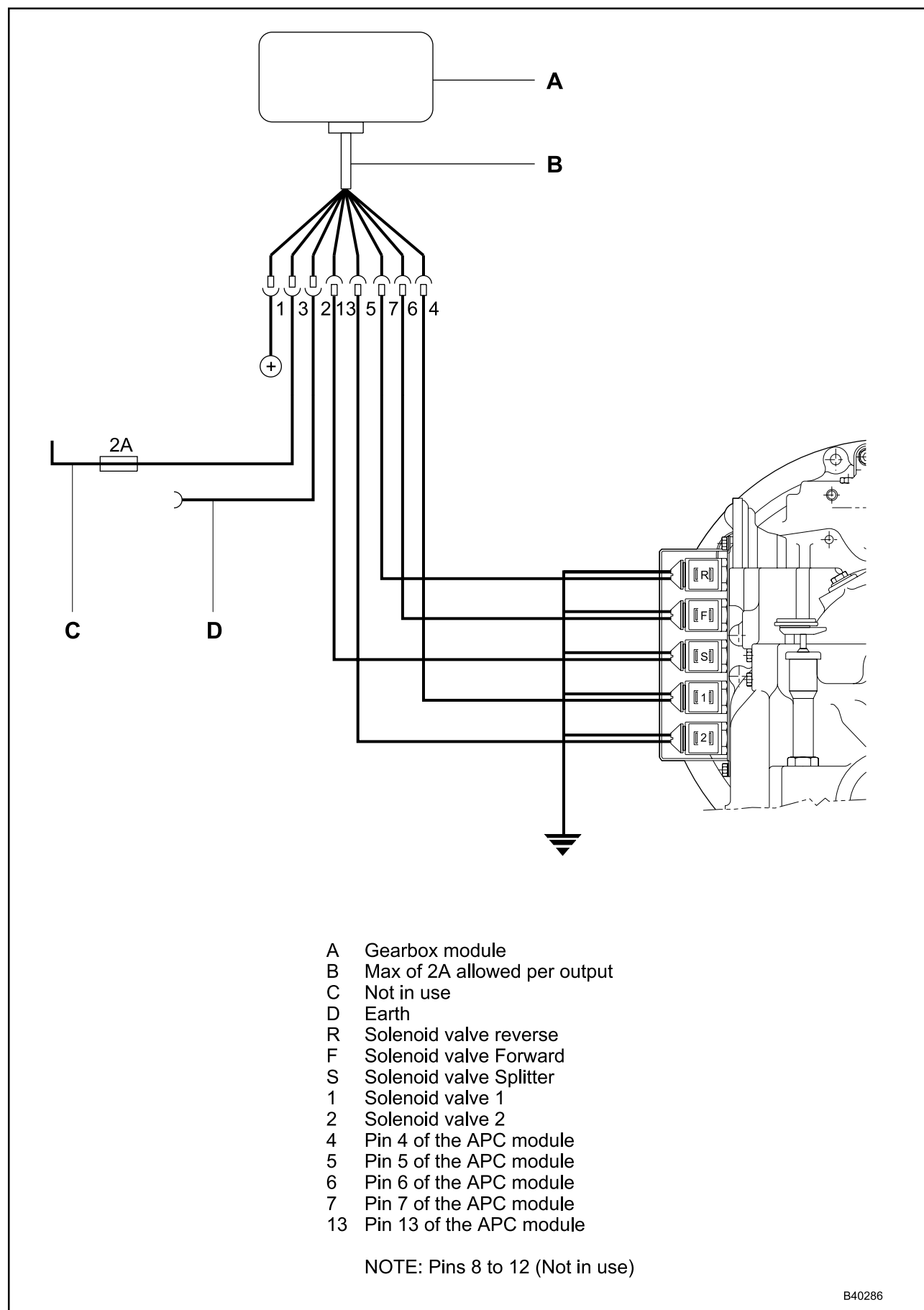


- D Gearbox module
- R Reverse solenoid valve
- F Forwards solenoid valve
- S Splitter solenoid valve
- 1 Solenoid valve 1
- 2 Solenoid valve 2

The solenoids are mounted on the left side of the gearbox.

- The reverse solenoid valve controls the reverse clutch.
- The forwards solenoid valve controls the oil flow to the splitter solenoid of the reverse solenoid.
- The splitter solenoid valve controls the oil to 4th high clutch and the forwards clutch.
- The solenoid valve 1 controls clutch 1.
- The solenoid valve 2 controls oil flow to clutch 2 or clutch 3.

Solenoids to module wiring



APC gear selector module

For a given gear selection the APC powershift controller will select the following gears:

Lever position	Gear selected (6/3 gearbox)	Gear selected (5/3 gearbox)	Gear selected (4/2 gearbox)
F6	6	—	—
F5	5	5	—
F4	4	4	4
F3	3	3	3
F2	2	2	2
F1	1	1	1
N	—	—	—
R1	1	1	1
R2	3	3	3
R3	3	3	3
R4	3	3	3
R5	5	5	—
R6	5	—	—

The speed limit for 6/3 gearbox models is 40 km/hr

The speed limit for 5/3 gearbox models is 25 km/hr

The speed limit for 4/2 gearbox models is 20 km/hr

APC display

A Display

M Mode selector

T Indicator (LED type):

On - When mode selector **M** is pressed once. Machine speed is displayed as turbine or input speed.

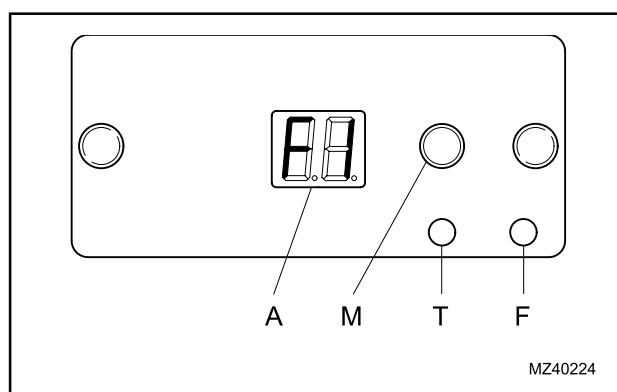
Off - When mode selector **M** is pressed twice and the machine is in motion.

Machine speed is displayed as Km/hr.

On - When mode selector **M** has been pressed twice, but machine is not in motion.

On - When mode selector **M** has been pressed twice, the machine is in motion, but there is no output from the speed sensor.

F Indicator (LED type), which indicates an APC fault.

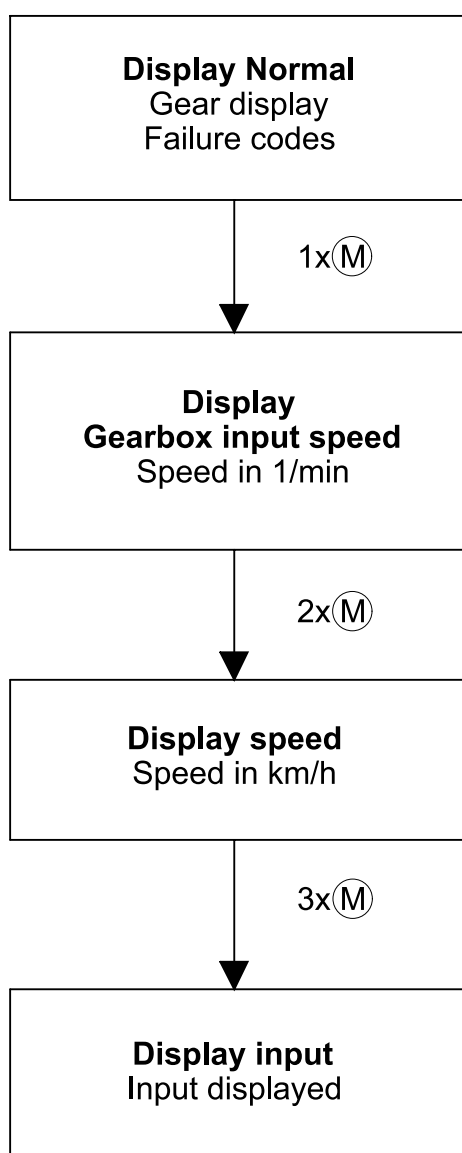


Display menus

The Gearbox module APC can display the following menus:

- Display normal
- Display gearbox speed
- Display forward speed
- Display Input signal.

Display normal is the standard display. The other display modes are selected by pressing the mode button (M) on the LED display forward of the steering column.



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Display Normal

The display normal mode gives the following information:

- the selected gear
- the failure codes.

Gear Selection

The gear display information is as follows:

- the gear selected with a number
- the direction selected with a letter

F - Forwards

R - Reverse

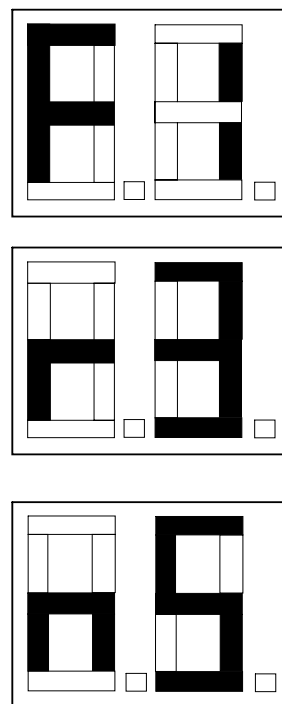
N - Neutral

Display

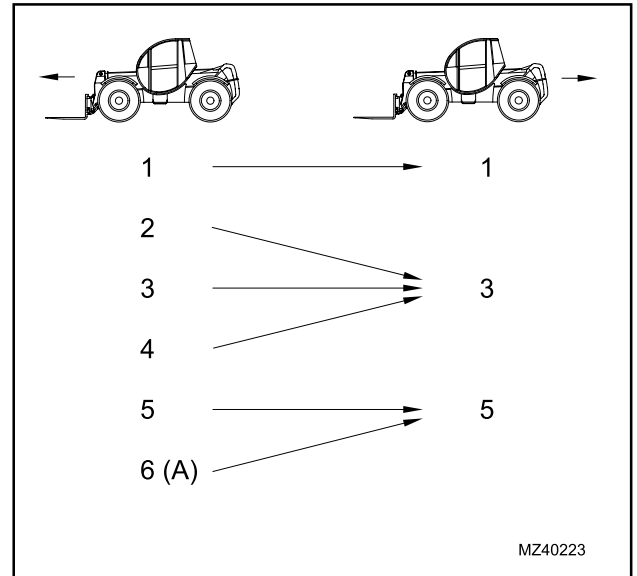
Forwards 1st gear

Reverse 3rd gear

Neutral 5th gear



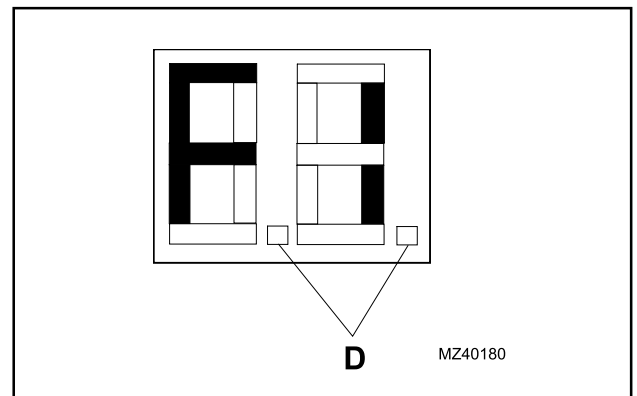
Because the gearbox only has three reverse gears (R1, R3 and R5), and the selector has six positions (R1 to R6), the actual gear selected in relation to the lever selection is shown in the following illustration.



Flashing dots in the display have the following meaning:

- The right dot indicates that the speed is too high for the downshift selected.
- The left dot indicates that the speed is too high for a direction change.

D = Flash



Failure codes

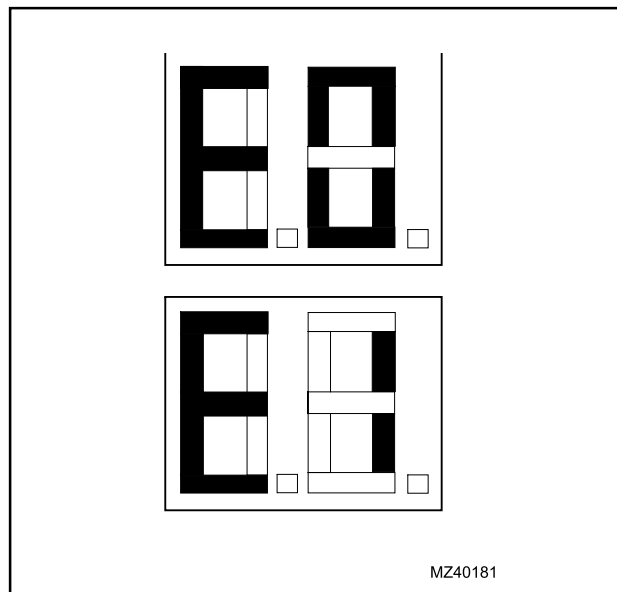
The display will automatically warn you of any ACTIVE failure codes by flashing the code in the display.

The following codes are available:

Display

Open circuit in output from APC to solenoids.
With this failure code the machine will stay in neutral.

The APC controller has received an input from the lever for forwards and reverse at the same time.
The gearbox will remain in neutral.



Display - Gearbox speed signal

The display - gearbox speed signal mode gives the gearbox input speed in revs per minute. To enter this mode press the mode button **(M)** on the LED display forward of the steering column once.

To read the correct speed the following instruction must be followed:

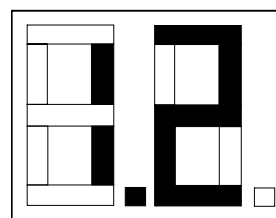
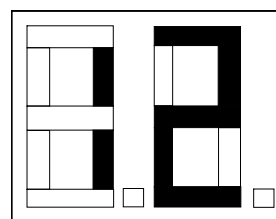
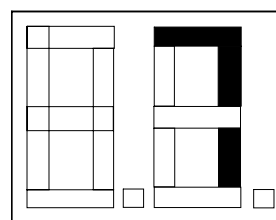
- Speeds up to 99 rpm are displayed using the first number only
- Speeds from 100 rpm to 999 rpm are displayed using the first two numbers
- For speeds over 1000 rpm the left LED dot is illuminated and the first two numbers are displayed.

Display

Display for any speed between 70 - 79 rpm

Display for a speed between 120 - 129 rpm

Display for a speed between 1200 - 1299 rpm



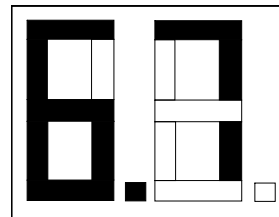
Display - Machine speed

The display machine speed mode gives the indicated forward speed in km/hr. To enter this mode press the mode button (M) on the LED display forward of the steering column twice.

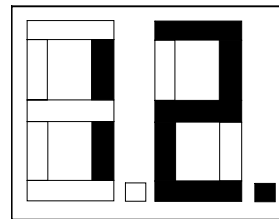
- The display will now indicate forward speed.
- The speed is in km/hr.
- The dot moves to indicate a two digit speed at all times.
- The LED is in the "Display Speed" mode.

Display

The machine speed is 6.7 km/hr



The machine speed is 12 km/hr



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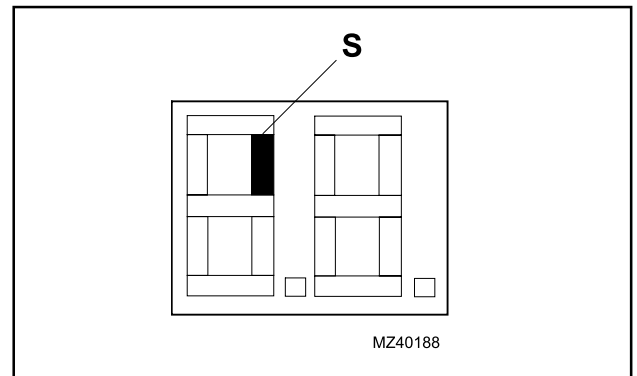
Display inputs

The input display mode allows the inputs to the APC module from the gear selection lever to be tested. To enter this mode press the mode button (M) on the LED display forward of the steering column three times.

The display will now show a segment illuminated to correspond with the input from the forward/reverse control lever.

Display

S = Segment



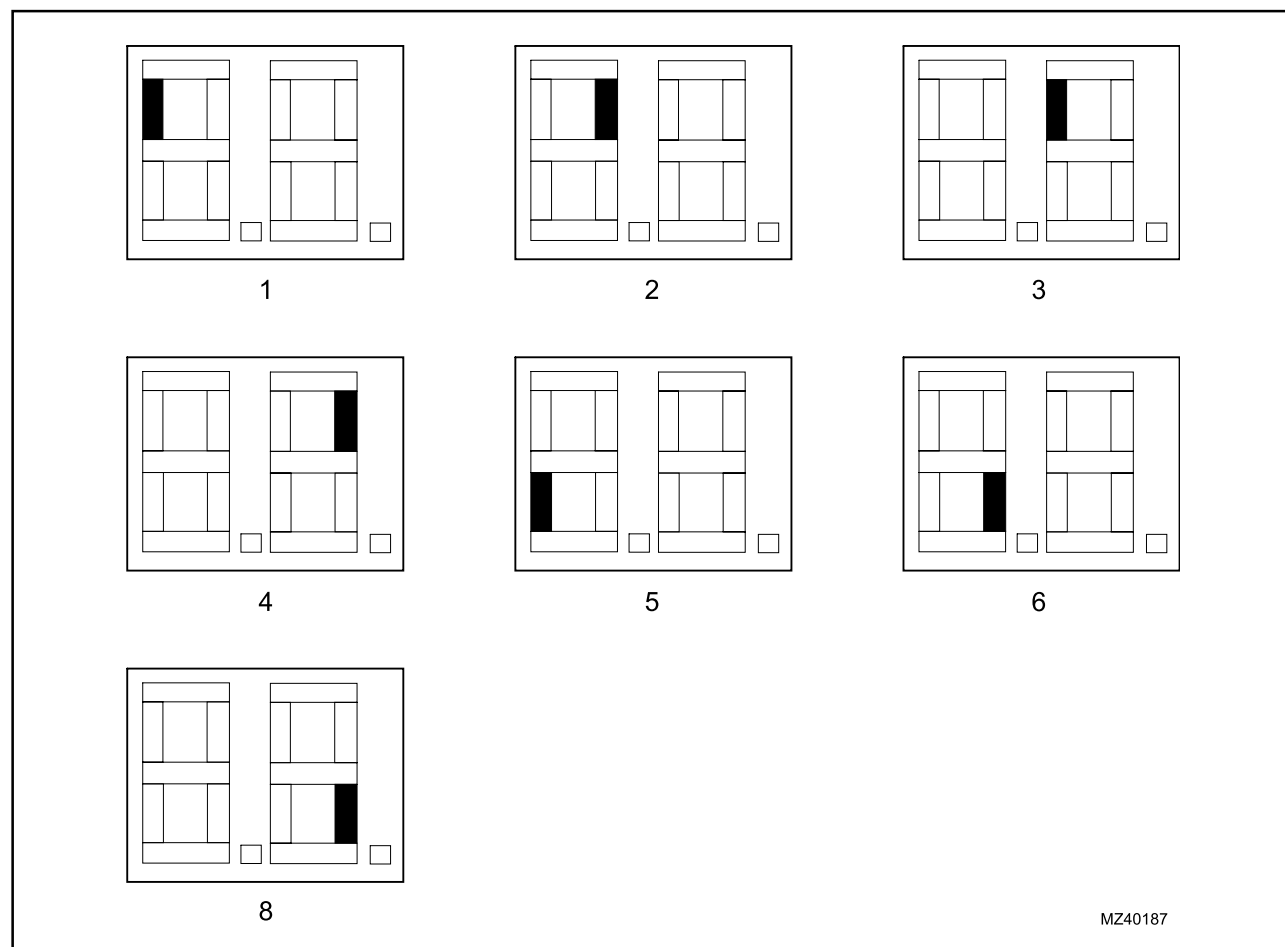
Example:

With the gear selection lever in forward, gear 1, pin 2 in the connector from the lever and pin 14 in the APC module is live.

Active pin in APC (Module)	Active pin in lever
14	2

Testing display inputs

All the signals from the lever to the APC can be tested. Segments in the LED are numbered 1 to 8 (No 7 is not used).



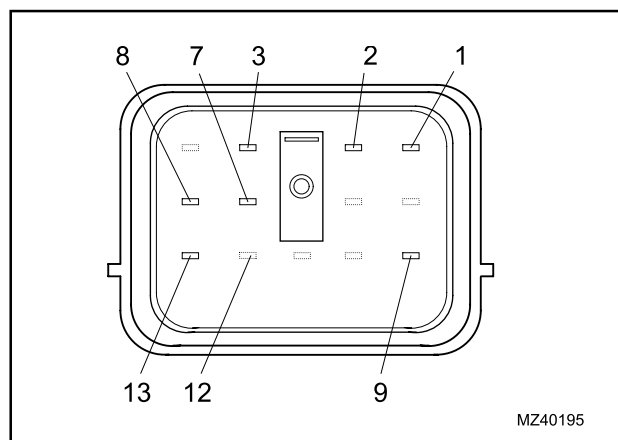
Operator function	Position of the segment	Pin on lever connection +ve	Pin on APC connector +ve
Lever forwards	1	3	12
Lever select 1st gear	2	2	14
Lever select 3rd gear	6	13	15
Lever select 5th gear	3	9	16
Kick-down button	4	1	26
Lever reverse	5	8	19
Brake dump switch	8	Pin external	25
Parking brake	8	Pin external	25
Lever select 2nd gear	2 + 6	2 + 13	14 + 15
Lever select 4th gear	3 + 6	9 + 13	16 + 15
Lever select 6th gear	2 + 3	9 + 2	16 + 14

Cable connections from lever to APC

Lever position	Active output pin from lever	Active input pin on APC module	Display with the selected gear "FORWARDS"	Display with the selected gear "REVERSE"
1	2	14	F1	r1
2	13 + 2	15, 14	F2	r3
3	13	15	F3	r3
4	13 + 9	15, 16	F4	r3
5	9	16	F5	r5
6	9 + 2	16, 14	F6	r5
Forwards	3	12	—	—
Reverse	8	19	—	—
Neutral	8	—	—	—

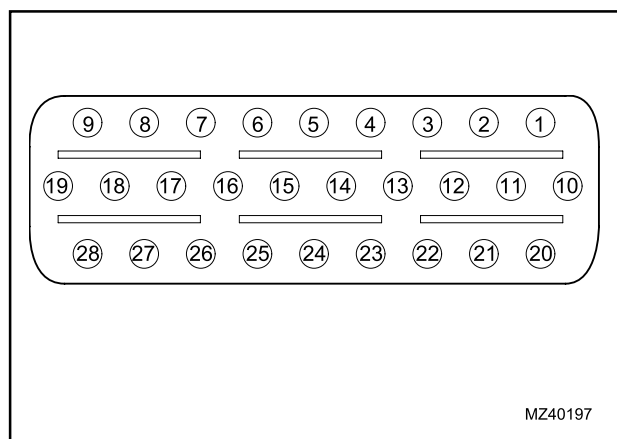
Pin location from lever

Pin on Control Lever	Cable colour
1	Red
2	Green
3	Purple
7	Blue
8	Yellow
9	Orange
12	Brown
13	Black
4, 5, 6, 10, 11	Not Used



APC pin layout

Pin	Function
1	Supply (+30)
2	Earth (-31)
3	Not Used
4	Solenoid 1
5	Solenoid 2
6	Solenoid Forward
7	Solenoid Reverse
8	Not Used
9	Not Used
10	30
11	31
12	Signal from Lever Pin 7
13	Signal to EMV Splitter (4th-High)
14	Signal from Lever Pin 5
15	Signal from Lever Pin 4
16	Signal from Lever Pin 3
17	Signal from Roothing Switch (Optional)
18	Not Used
19	Signal from Lever Pin 6
20	Input Speed Sensor
21	Module Ground 31
22	Earth for Speed Sensor
23	Earth
24	Not Used
25	Signal from Brake Dump Switch
26	Signal from Kick-down Button
27	Not Used
28	Not Used



Testing output from APC

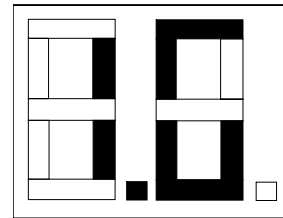
The outputs from the APC Module can be tested. To enter this mode press and hold down the mode button (**M**) on the LED display whilst turning on the ignition to the first position.

The APC module will now test all the outputs by sending a test current through the cables. The display then uses the following letters to indicate the condition of the circuit as follows:

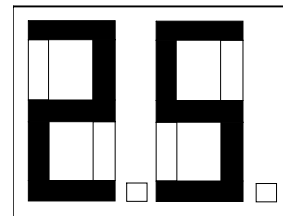
- G = Good
- S = Short to Earth
- O = Open circuit or short to positive.

Display

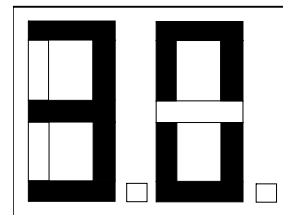
Output 1 is tested and is **GOOD** (G)



Output 2 is tested and is **SHORTED TO EARTH** (S)



Output 3 is tested and is **OPEN CIRCUIT OR SHORT TO POSITIVE** (O)



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When in the test mode the APC automatically scrolls through all the output test (1 through 8). Pins 3, 8 and 9 are not active. When they are tested the display should indicate an open circuit (O).

Display Reading	APC Output Pin	Remarks	Normal output viewed in APC
1	6	EMV Forwards	1G
2	7	EMV Reverse	2G
3	4	EMV1	3G
4	5	EMV2	4G
5	9	Not Used	5O
6	13	Signal to EMV Splitter	6G
7	8	Not Used	7O
8	3	Not Used	8O

Kick-down

When the KICK-DOWN button is pressed, the machine will change down a gear. The kick-down function will only be cancelled by the following actions:

1. The KICK-DOWN button is pressed again.
2. The direction of travel is changed.
3. The gear selected is changed.

If the KICK-DOWN button is pressed but the speed is too high to change down, the gear will not be changed. The APC will wait for up to 5 seconds for the speed to drop. If the speed does not drop sufficiently, the command to change down is disregarded.

Automatic gear change

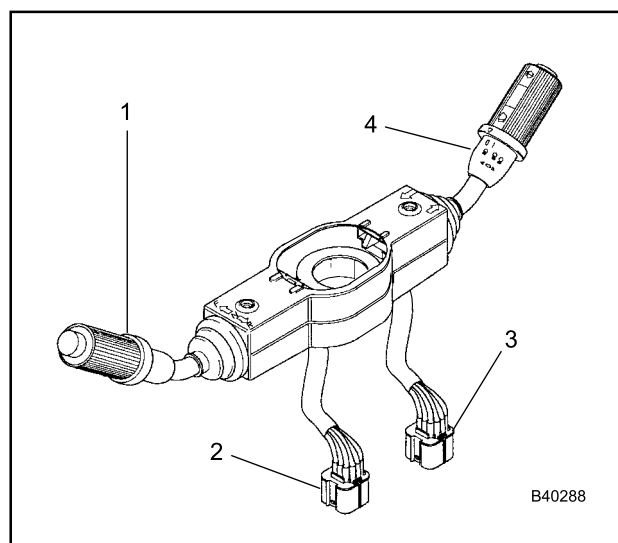
The 6/3 Gearbox has automatic shifting in the higher gears. This system is controlled by the APC. It uses the signal from the gearbox speed sensor to control the engagement of 5th and 6th gears when the lever is in the automatic mode (A). If the lever is in 5th, the APC will control the engagement of 5th gear only.

Option without APC

A gearbox selection option is available. This uses a non APC selector. The gearbox remains the same but with this option the following are not available:

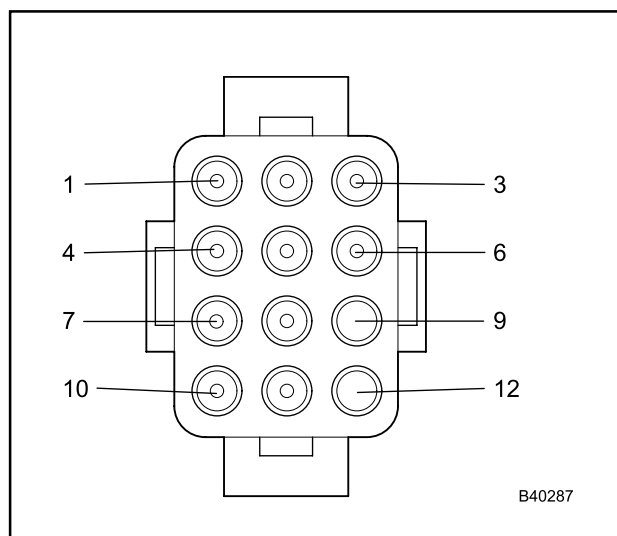
- Speed sensor
- Gearbox APC module
- Display menu in cab
- Kickdown
- Automatic switching.

Control lever



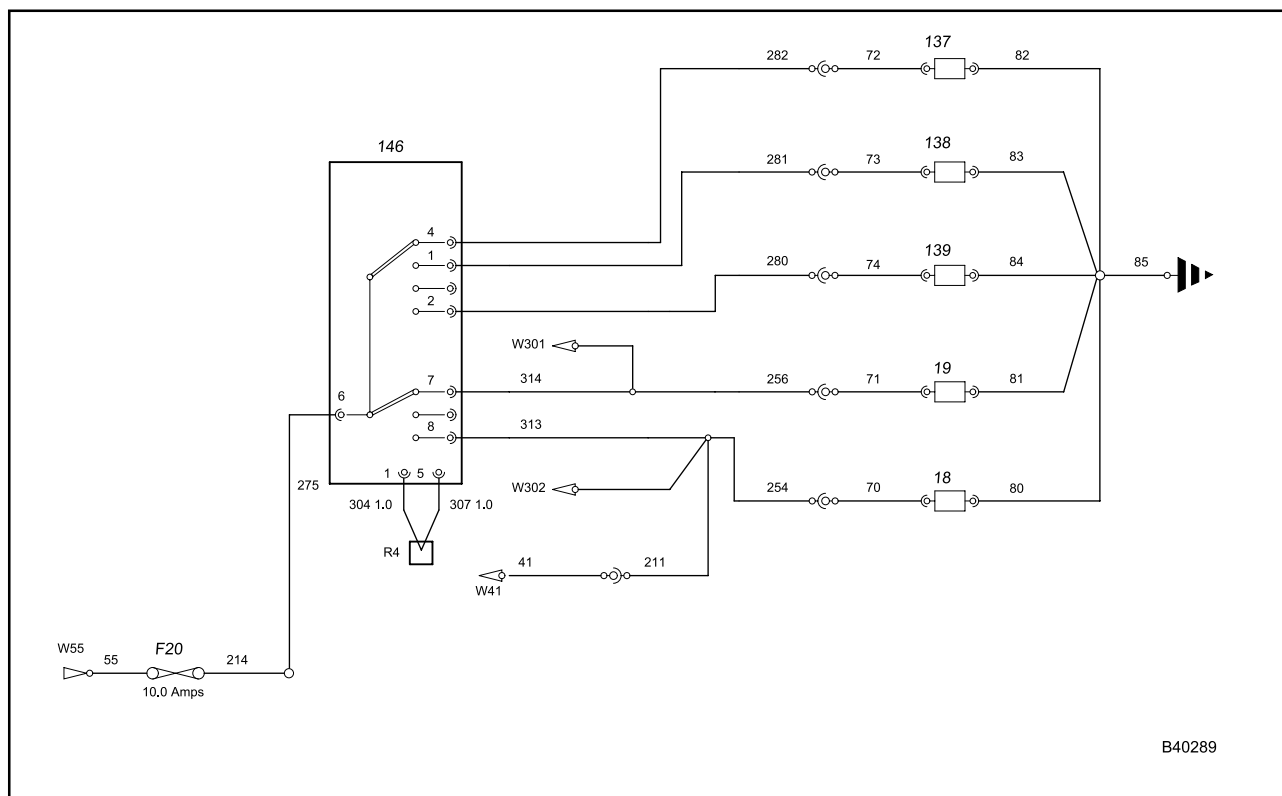
1. Control lever
2. Connector to solenoid valves
3. Multi-function lever
4. Connector from multi-function lever to services

Pin layout for control lever



Pin on Control Lever	Cable colour	Function
1	Grey	Solenoid valve 1
2	Yellow	Solenoid valve 2
4	White	Solenoid valve S
5	Red	Travel direction switch
7	Blue/Yellow	Solenoid valve F
8	White/Green	Reverse solenoid
11	Blue	Power supply
3, 6, 9, 10, 12	—	Not used

Control lever to solenoid circuit



Component location	Relay	Notes
R4	Brake clutch relay	Separate, near fuse box
W302	Starting lock (travel lever in forwards position)	Separate, near fuse box
W301	Starting lock (travel lever in reverse position)	Separate, near fuse box
139	Solenoid valve 2	The solenoid valve controls the relative clutch in the gearbox
138	Solenoid valve 1	The solenoid valve controls the relative clutch in the gearbox
137	Solenoid valve S	The solenoid valve controls the relative clutch in the gearbox
146	Switch, travel direction (V, N, R lever) / gear change switch (travel lever)	Supplied by Britax
18	Reverse solenoid valve	
19	Solenoid valve F	The solenoid valve controls the relative clutch in the gearbox

Solenoid switching pairs**4/3 gearbox**

Gear	Active solenoid valve	Switched clutch
F4	F, S and 2	4th high and 2
F3	F and 2	Forwards clutch 2
F2	F, S, 1 and 2	4th high and 1
F1	F, 1 and 2	Forwards and 1
R1	Reverse, 1 and 2	Reverse and 1
R2	Reverse and 2	Reverse and 2
R3	Reverse	Reverse and 3

In travel lever position R4 the gearbox switches into the R3 gear

3/3 gearbox

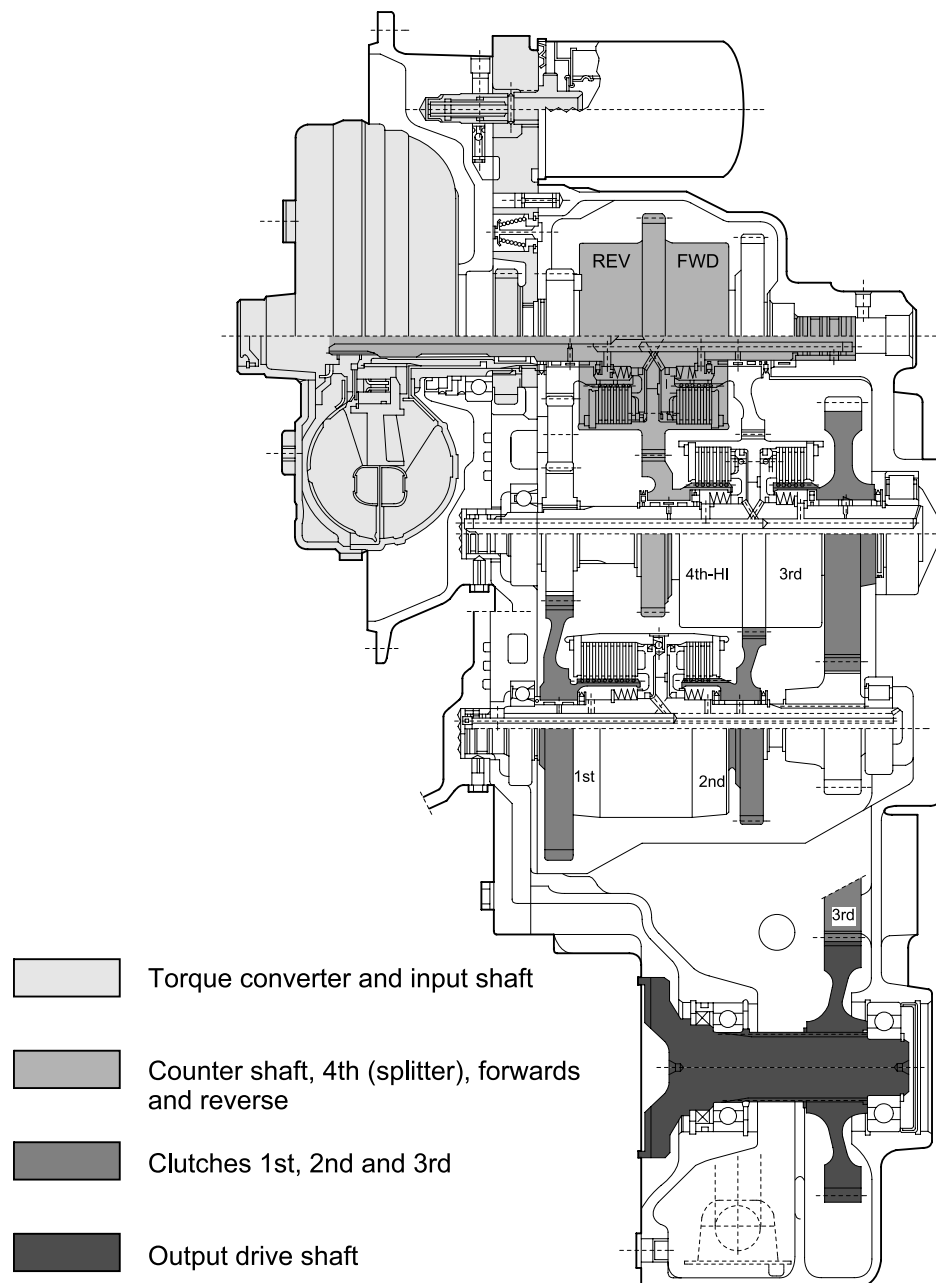
Gear	Active solenoid valve	Switched clutch
F4	F, S and 2	4th high and 2
F3	F and 2	Forwards clutch 2
F2	F, S, 1 and 2	4th high and 1
F1	F, 1 and 2	Forwards and 1
R1	Reverse, 1 and 2	Reverse and 1
R2	Reverse and 2	Reverse and 2
R3	Reverse	Reverse and 3

In travel position F4 the gearbox switches into the F3 gear

In travel position R4 the gearbox switches into the R3 gear

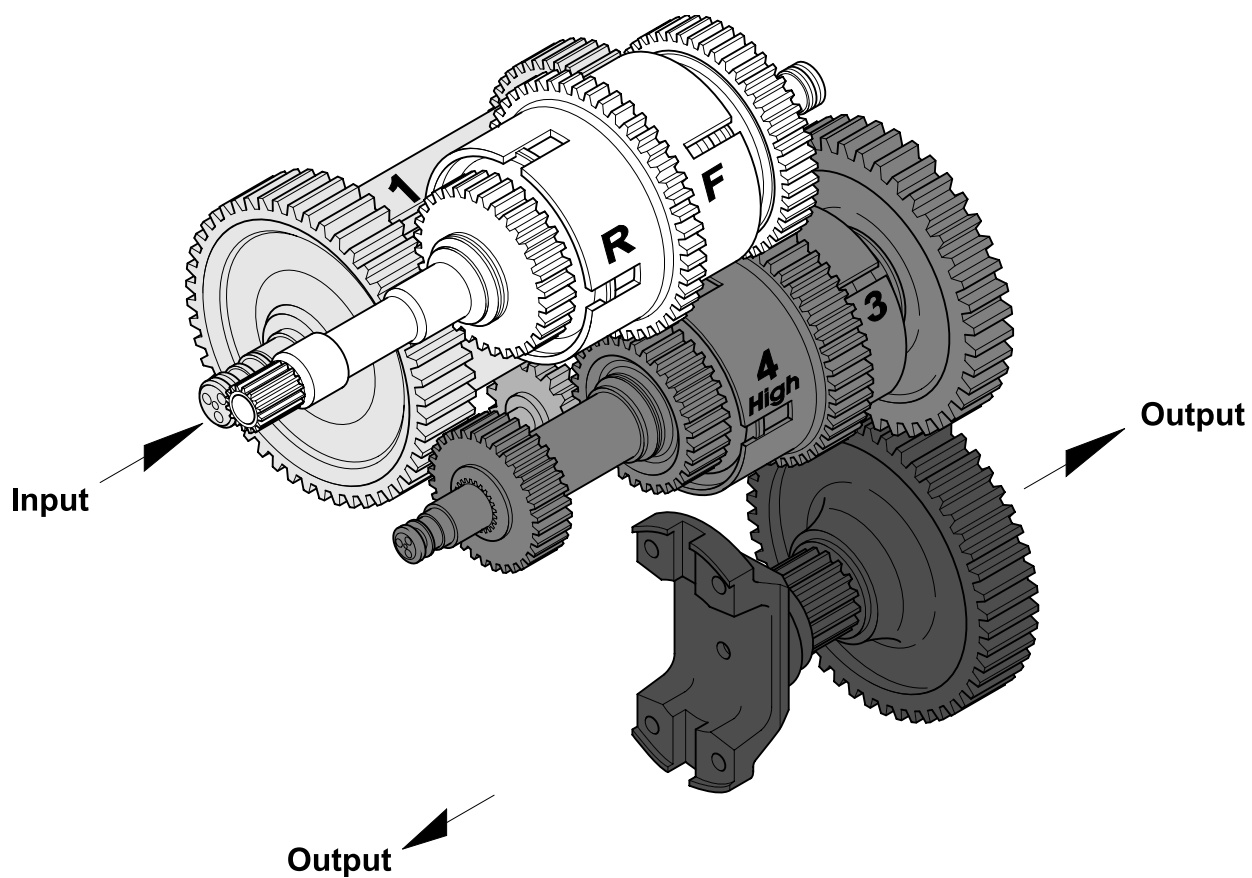
Gearbox power flow






The gearbox has 6 clutches to select the 6 forward and 3 reverse gears.



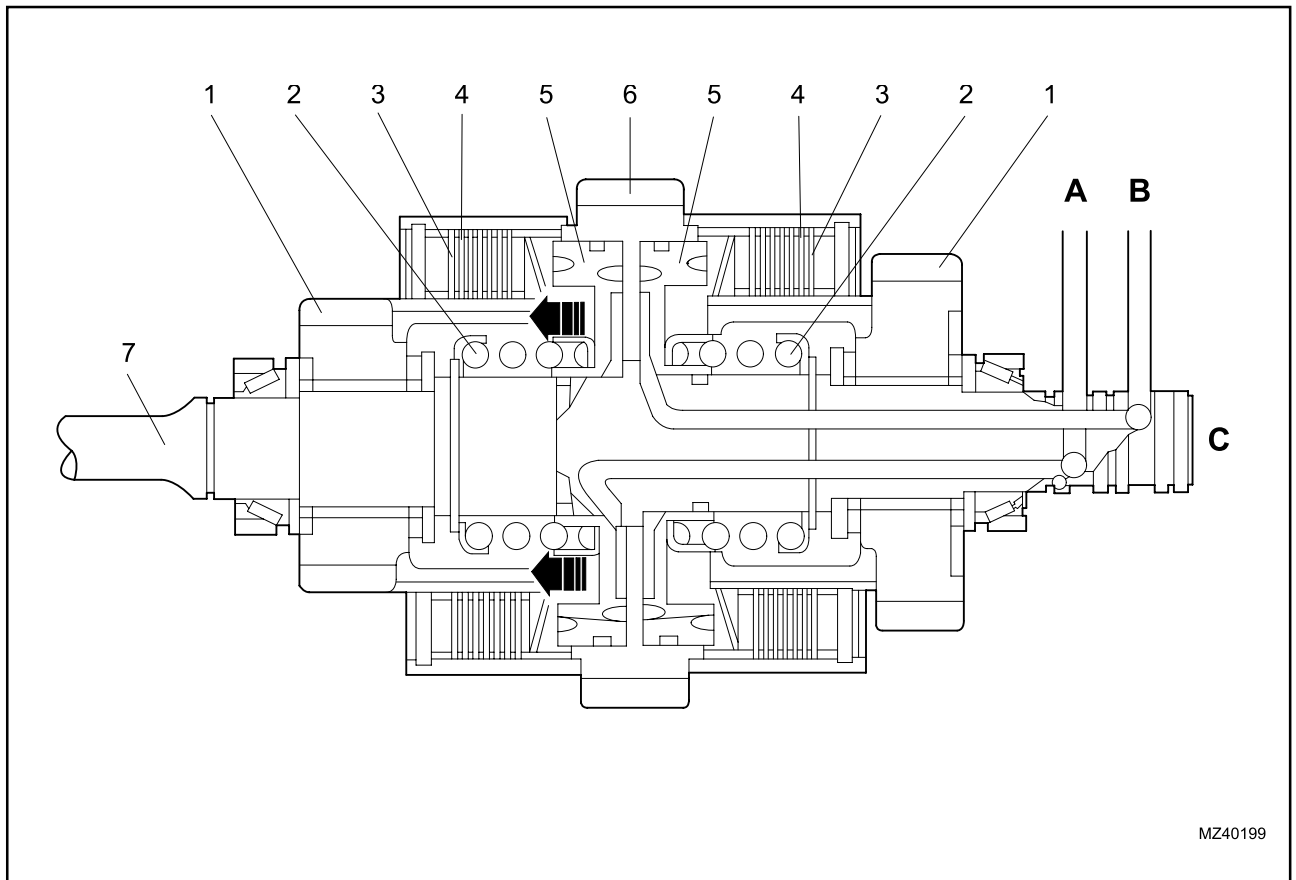
MZ40200

Gear and clutch layout



- | | |
|---|----------------------|
|  | Forwards and Reverse |
|  | 1st and 2nd |
|  | Reverse idler |
|  | 4th high and 3rd |
|  | Output section |

Transmission clutches



Position	Function	Remarks
1	Driven gear wheel	Transmission input to the clutch assembly
2	Pressure spring	Fitted outside piston to return piston to the disengaged position
3	Thrust washers	Fitted between the clutch plates to transmit drive
4	Clutch discs	Transmits the drive to the clutch packs
5	Piston	With hydraulic oil pressure fed in behind, compresses the clutch packs
6	Driven gear wheel	Transmits drive to the clutch packs
7	Drive shaft	The drive shaft is only connected to gear 6 and outer basket
A	Clutch oil supply	Oil is directed behind the left piston to engage that clutch
B	Clutch oil supply	Oil is directed behind the right piston to engage that clutch
C	Lubricant oil supply	Lubricant oil is used to cool the clutch parts during engagement and to lubricate during disengagement

Function

With a double clutch in use, only one of the clutches will be closed. The clutch housing will be driven either via the drive gear (6) or by the drive shaft.

For example, if pressure is supplied to connector A from the related solenoid valve, it will press against the ram (5), the clutch plate (4) then presses against the lining and therefore the clutch is closed.

The clutch plate (4) is now tied in with the drive shaft (5) via the clutch housing and so the clutch drives. The power goes from the drive shaft (7) via the clutch pack onto the drive gear (1).

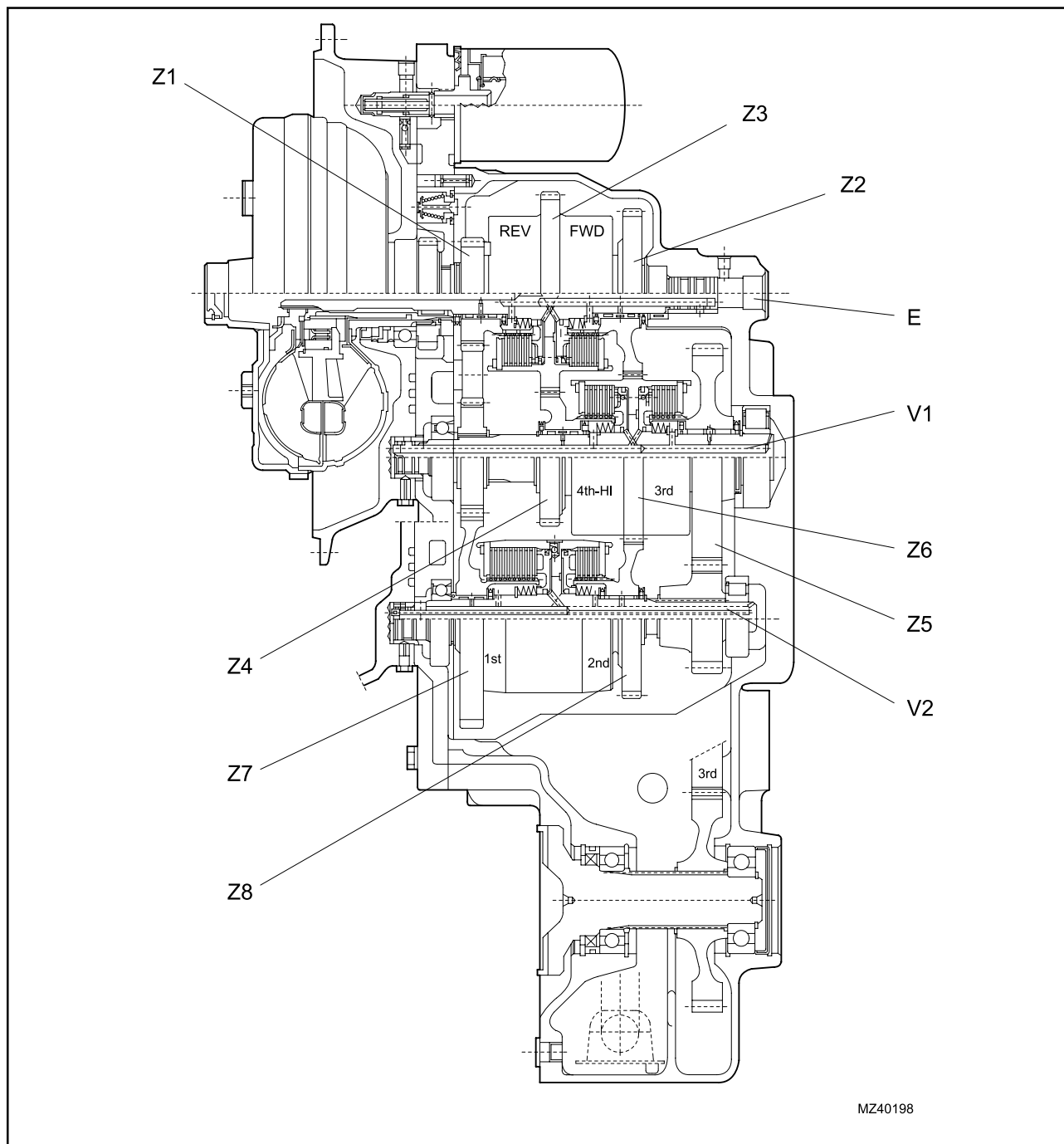
Connection B for the non-operated clutch has a connection via the related solenoid valve back to tank, the spring (2) and ram (5) are in the disengaged position and therefore the clutch is open.

The connection of the non-activated clutch is related to the return motion and the solenoid valve, so that the pressure spring (2) moves the piston (5) to the output position and thus separating the coupling.

The clutch unit is supplied with lubricating oil via connection C. The lubrication oil flows through the grooves and reduces the heat during the take up phase.

The lubrication oil is supplied from the gearbox pump via the oil cooler to the clutch packs.

Powershift gearbox T12000



- Z1 Gear 1 with reverse clutch assembly
- Z2 Gear 2 with forwards clutch assembly
- Z3 Gear 3 mounted on input shaft
- Z4 Gear 4 with 4th high clutch assembly
- Z5 Gear 5 with 3rd clutch assembly
- Z6 Gear 6 with counter shaft assembly
- Z7 Gear 7 with 1st clutch assembly
- Z8 Gear 8 with 2nd clutch assembly
- E Input shaft
- V1 Intermediate shaft 1
- V2 Intermediate shaft 2

Solenoid/gear selection tables

Table for 6/3 Gearbox

Gear	Active EMV	Clutches Engaged
F6	Forwards and Splitter	Splitter (4th high) and 3rd
F5	Forwards	Forwards and 3rd
F4	Forwards Splitter and 2	Splitter (4th high) and 2nd
F3	Forwards and 2	Forwards and 2nd
F2	Forwards Splitter 1 and 2	Splitter (4th high) and 1st
F1	Forwards 1 and 2	Forwards and 1st
R1	Reverse 1 and 2	Reverse and 1st
R3	Reverse and 2	Reverse and 2nd
R5	Reverse	Reverse and 3rd

Table for 5/3 Gearbox

Gear	Active EMV	Clutches Engaged
F5	Forwards	Forwards and 3rd
F4	Forwards Splitter and 2	Splitter (4th high) and 2nd
F3	Forwards and 2	Forwards and 2nd
F2	Forwards Splitter 1 and 2	Splitter (4th high) and 1st
F1	Forwards 1 and 2	Forwards and 1st
R1	Reverse 1 and 2	Reverse and 1st
R3	Reverse and 2	Reverse and 2nd
R5	Reverse	Reverse and 3rd

In the 5/3 gearbox 6th gear is not used.

Table for 4/2 Gearbox

Gear	Active EMV	Clutches Engaged
F4	Forwards Splitter and 2	Splitter (4th high) and 2nd
F3	Forwards and 2	Forwards and 2nd
F2	Forwards Splitter 1 and 2	Splitter (4th high) and 1st
F1	Forwards 1 and 2	Forwards and 1st
R1	Reverse 1 and 2	Reverse and 1st
R3	Reverse and 2	Reverse and 2nd

In the 4/2 gearbox, 5th, 6th and Reverse 5th gears are not used.

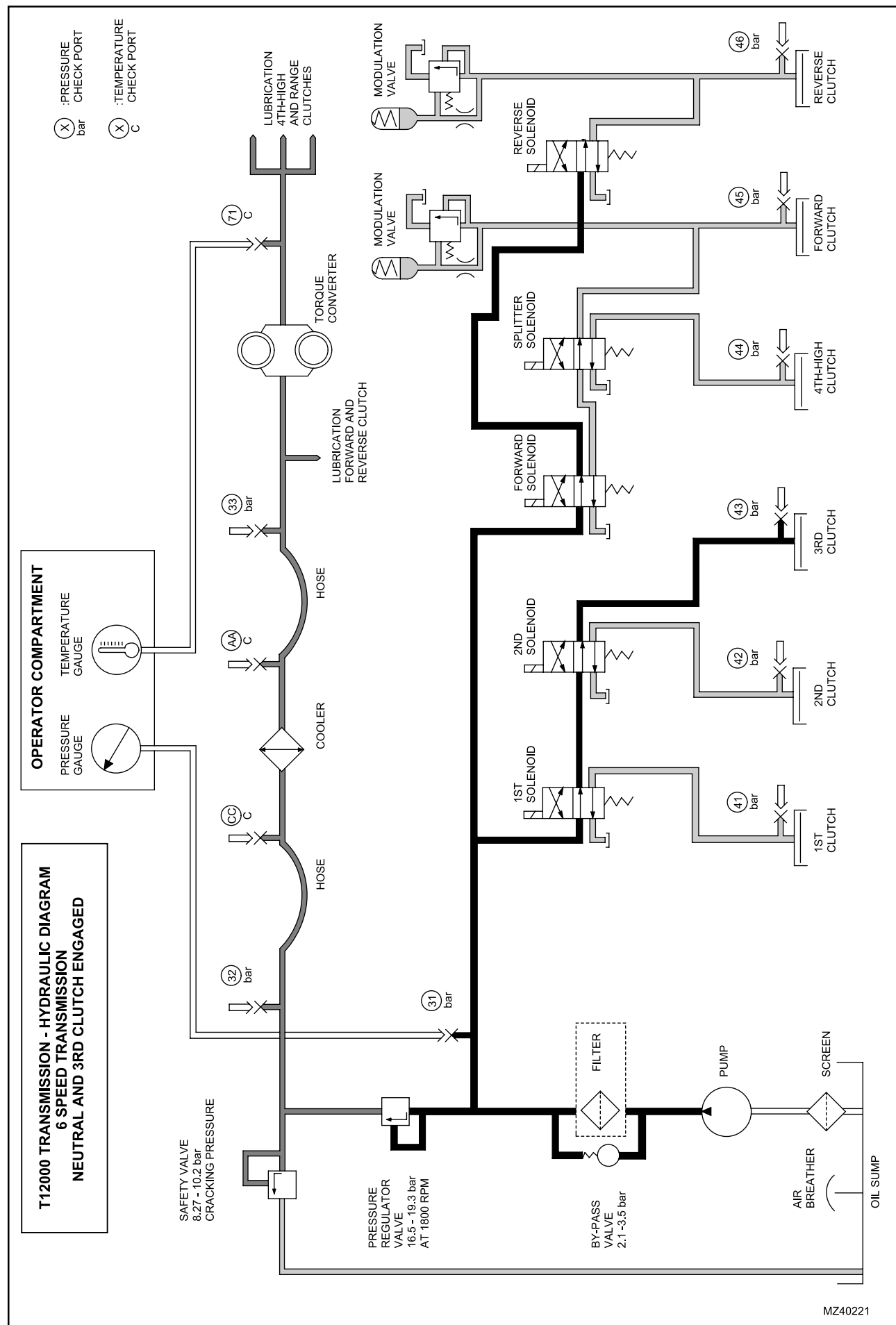
Gearbox hydraulic selection plans

NOTE: All schematics shown are typical. Machine circuits may vary.

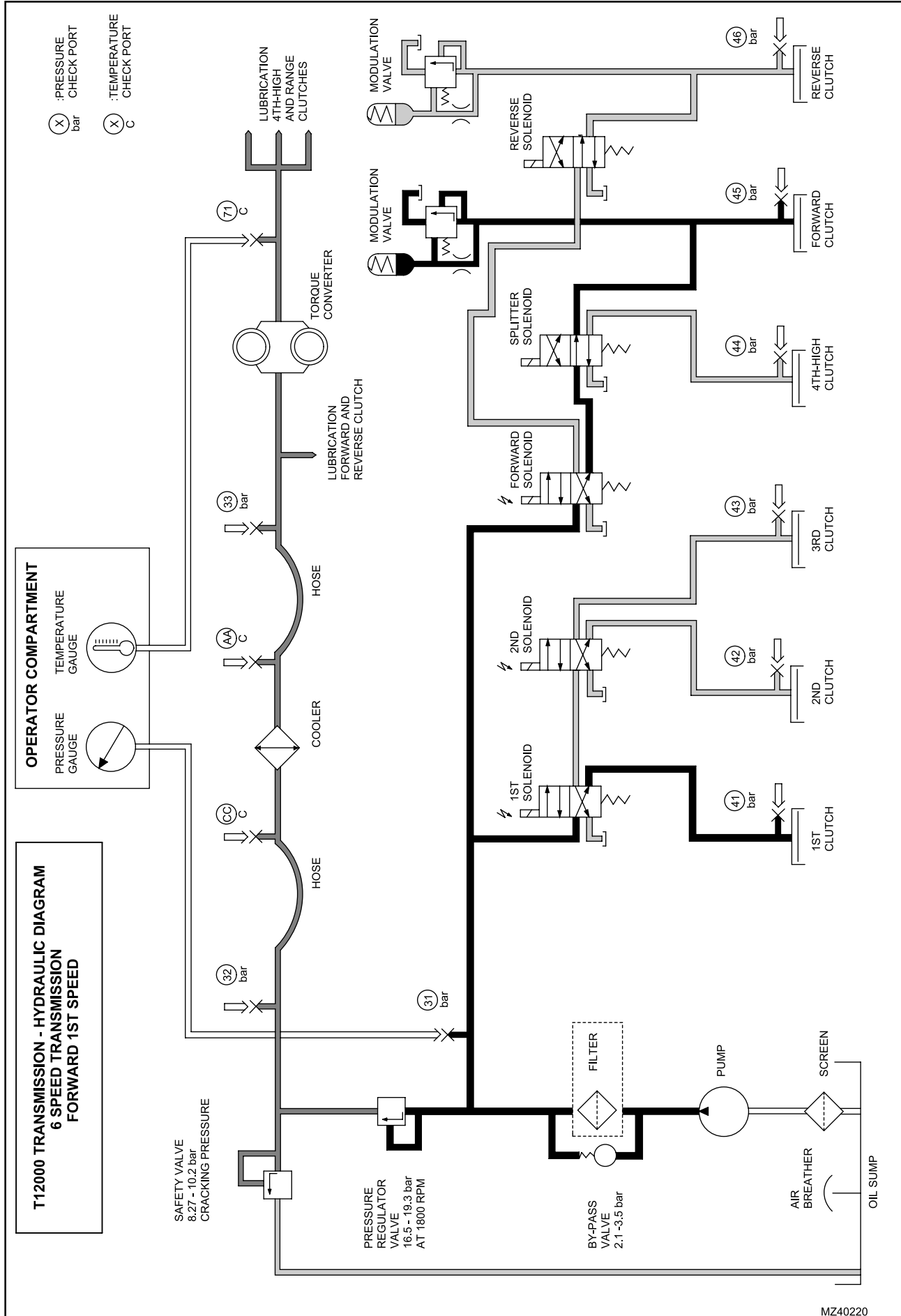
NOTE: The description in the following table is applicable to the gearbox hydraulic selection plans for all gears.

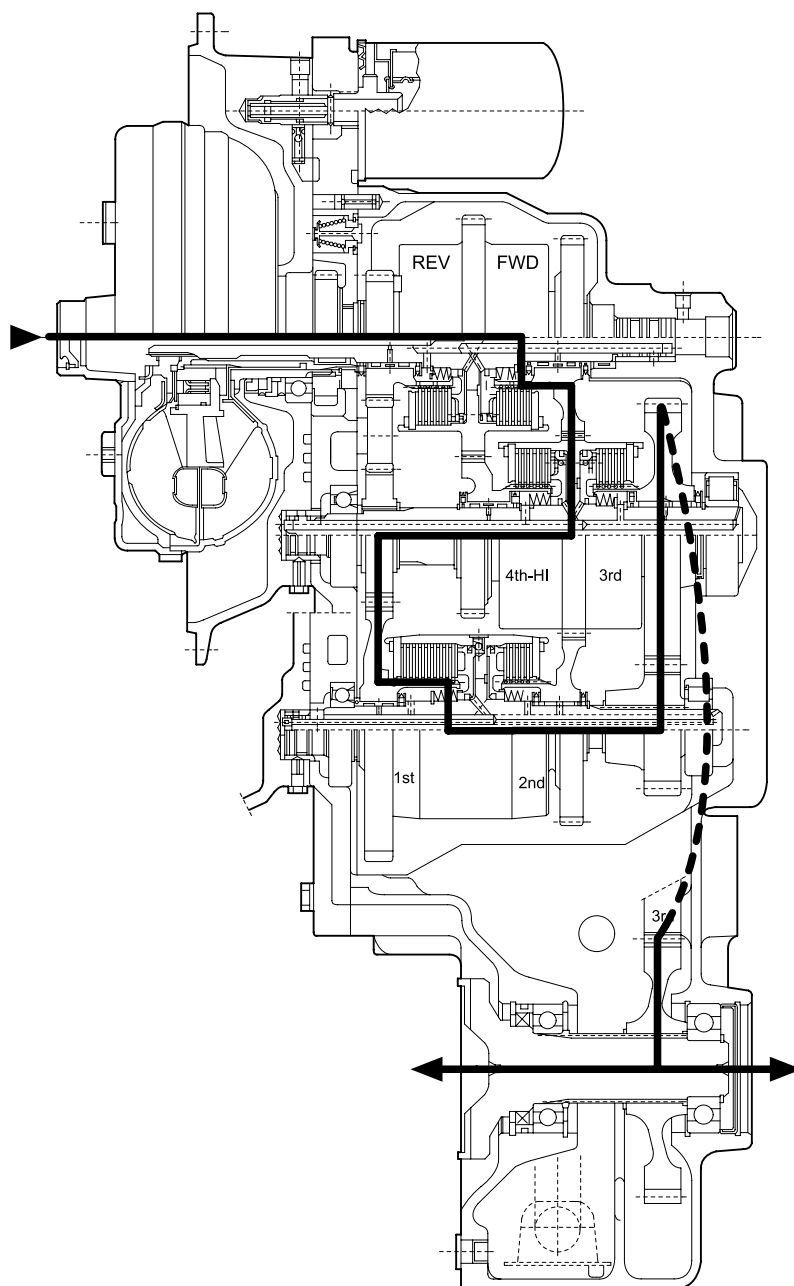
Component	Remarks
Pressure Regulator Valve	Regulates the system pressure to 16.5 - 19.3 bar
Safety Valve	Secures the Torque Convertor and cooling circuit to 8.27 - 10.2 bar
Cooler	
Lubrication Forward and Reverse Clutch	Pressure in the lubrication line runs at 2.9 - 4.0 bar
Torque Convertor	Connects the Engine to the Transmission
Lubrication 4th High and Range Clutch	Pressure in this circuit is 2.9 - 4.0 bar
Modulation Valve	Build Forwards and Reverse clutch pressure up slowly
Reverse Solenoid	Closes the Reverse clutch
Splitter Solenoid	Controls the pressure of the 4th High clutch or the forwards clutch
Forward Solenoid	Controls the pressure to the Splitter Solenoid or the Reverse Solenoid
2nd Solenoid	Closes Clutch 2 or 3
1st Solenoid	Closes Clutch 1
Reverse Clutch	
Forward Clutch	
4th High Clutch	
3rd Clutch	
2nd Clutch	
1st Clutch	
	Solenoid energised

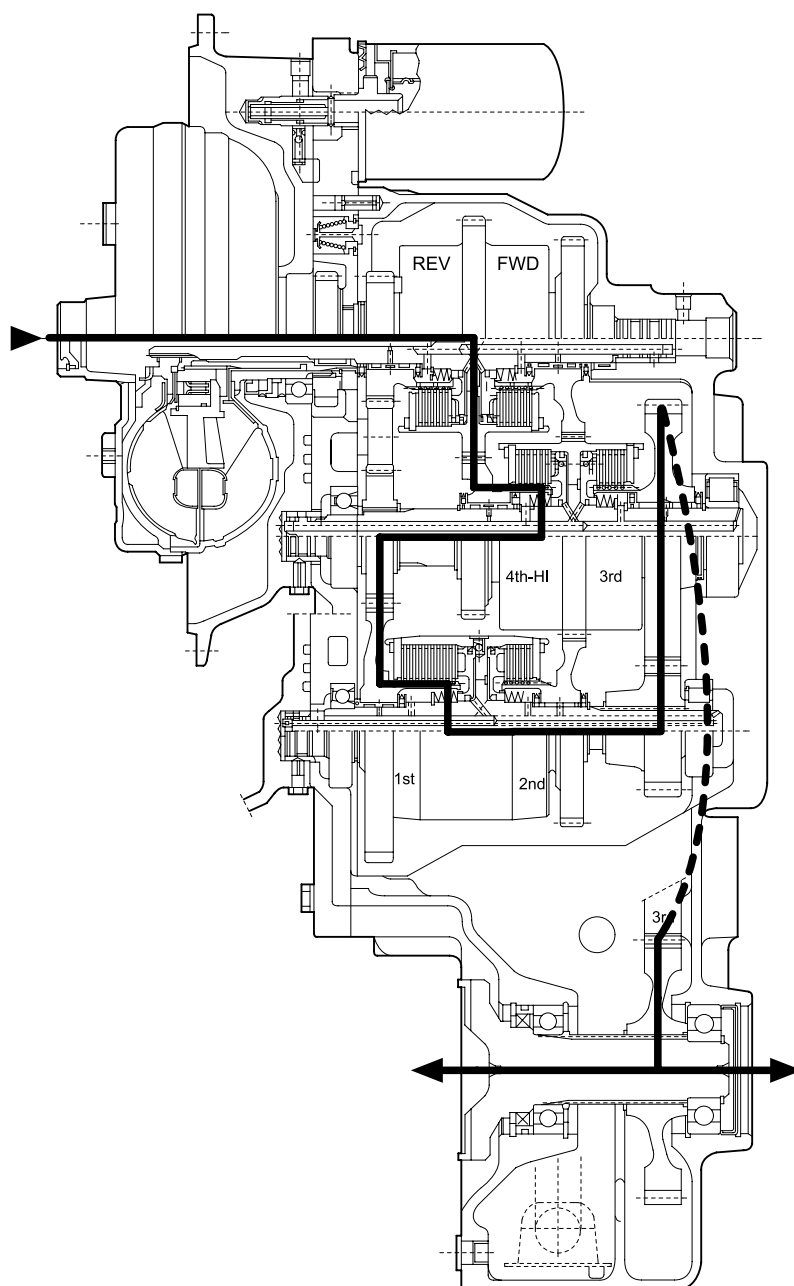
Neutral

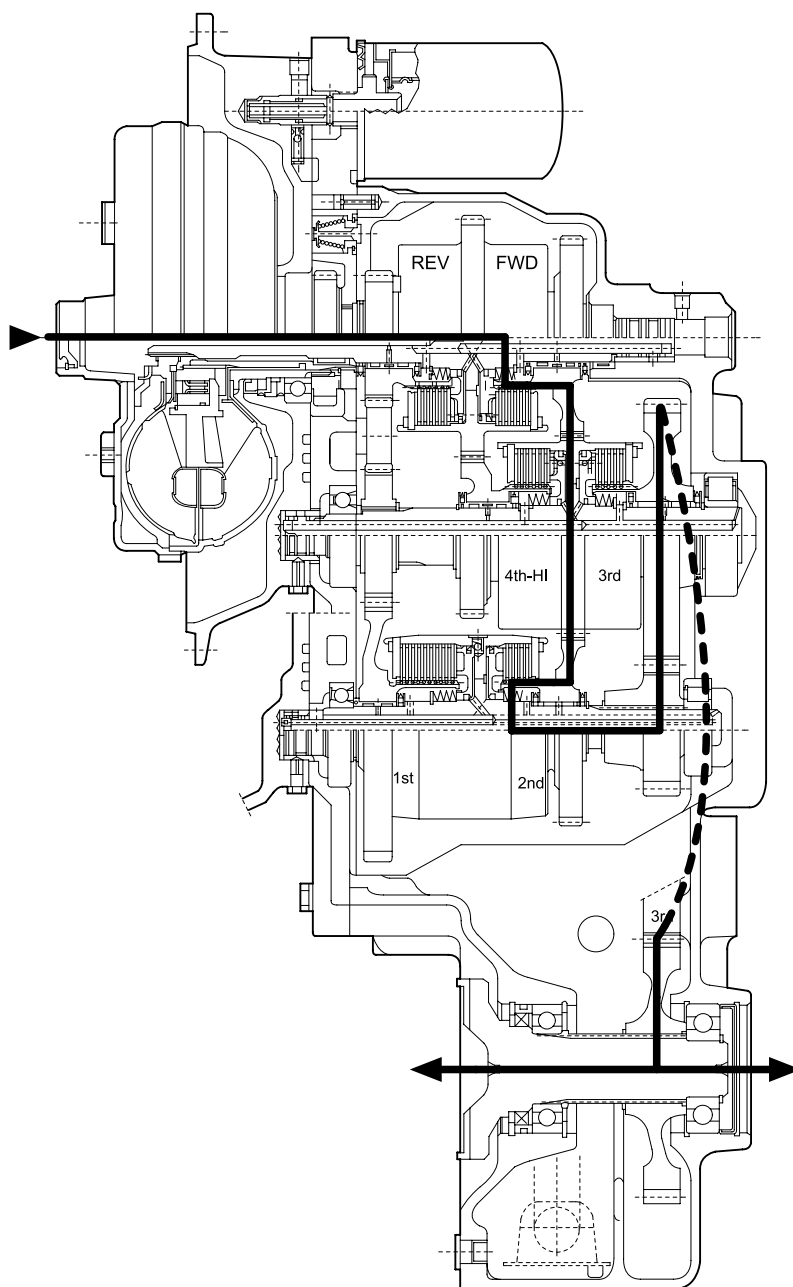


1st gear

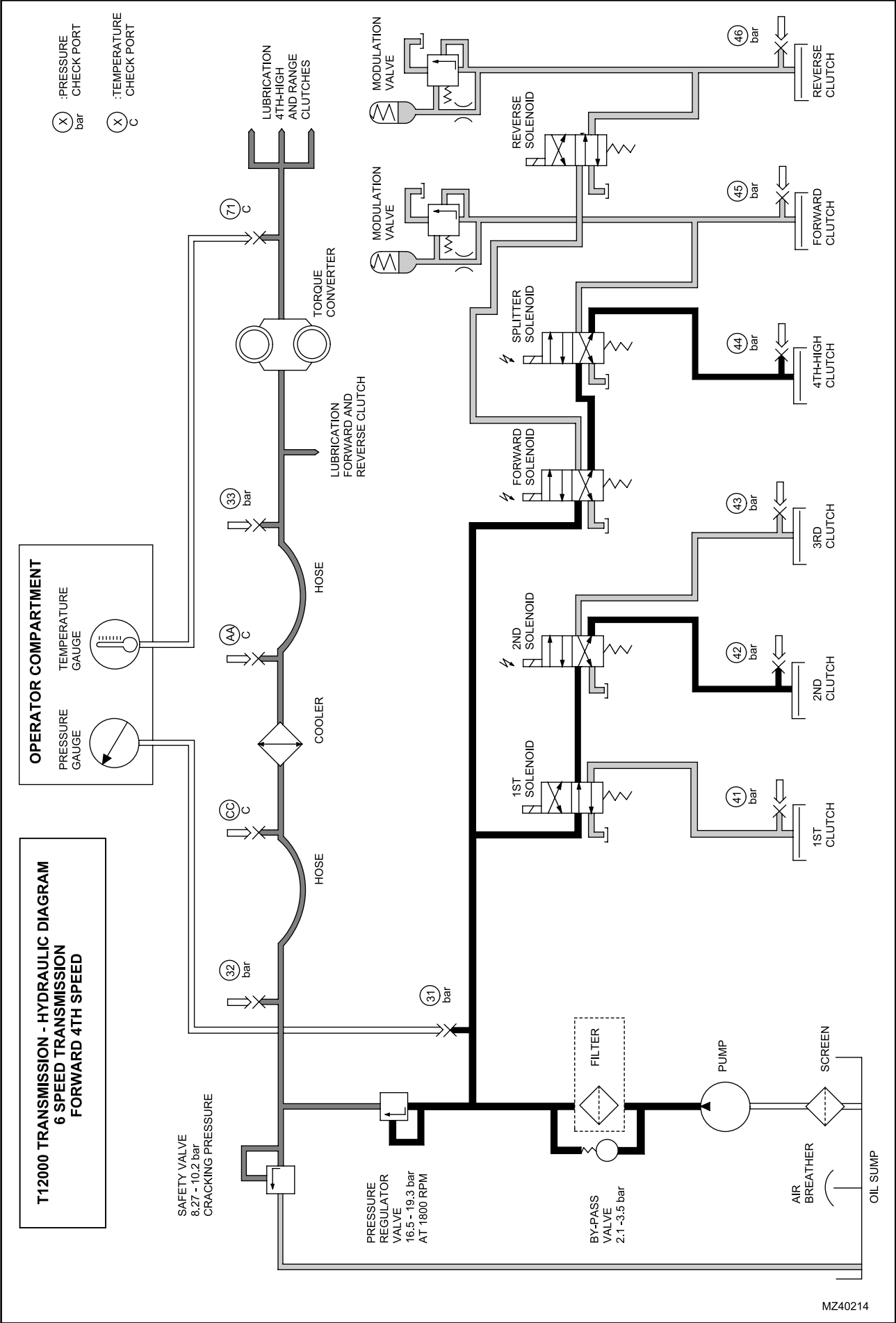


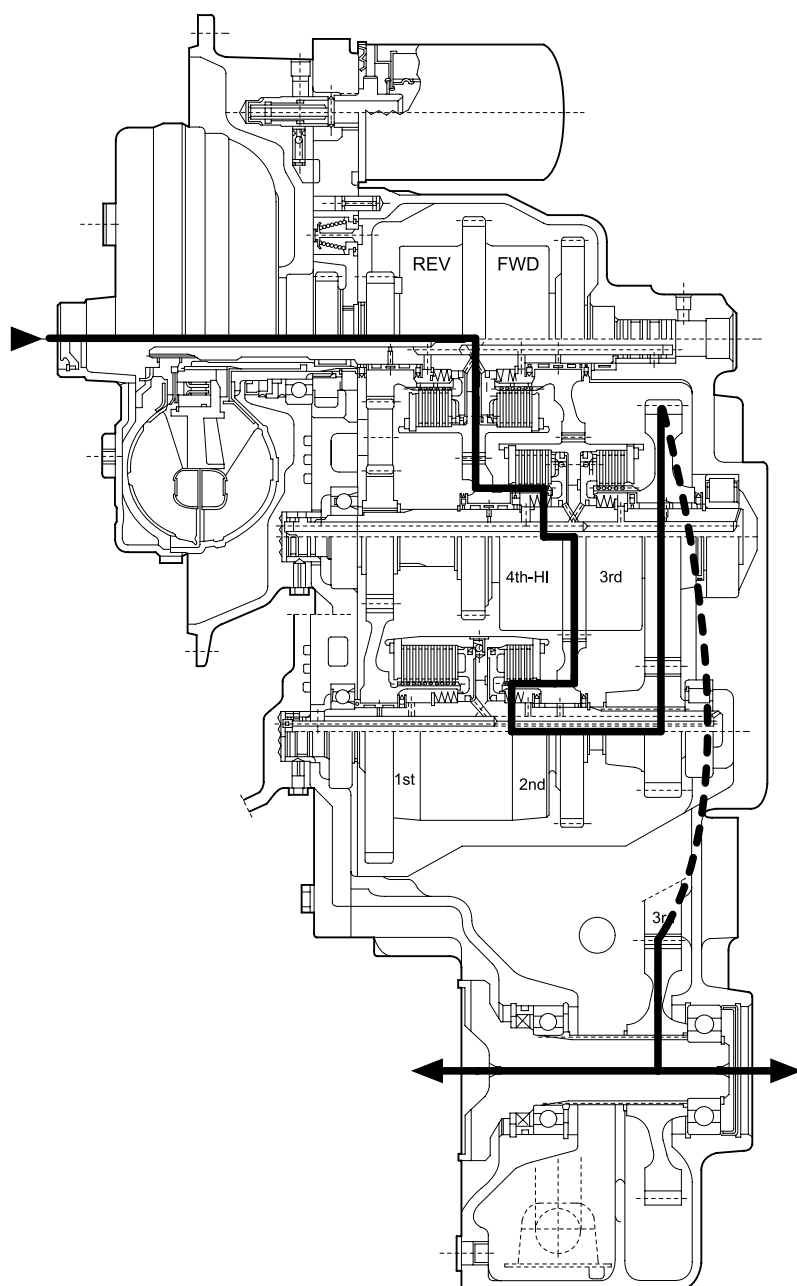




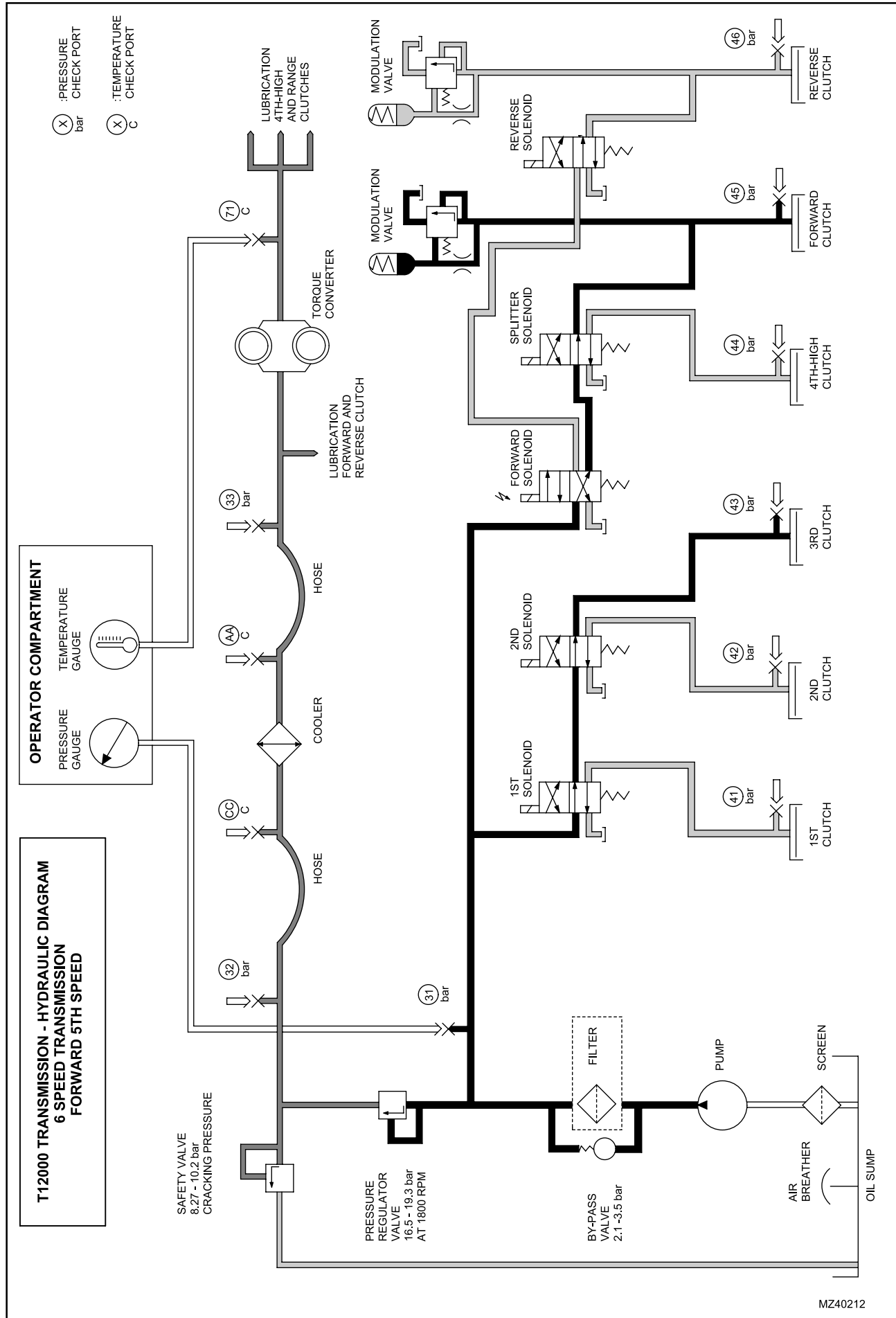


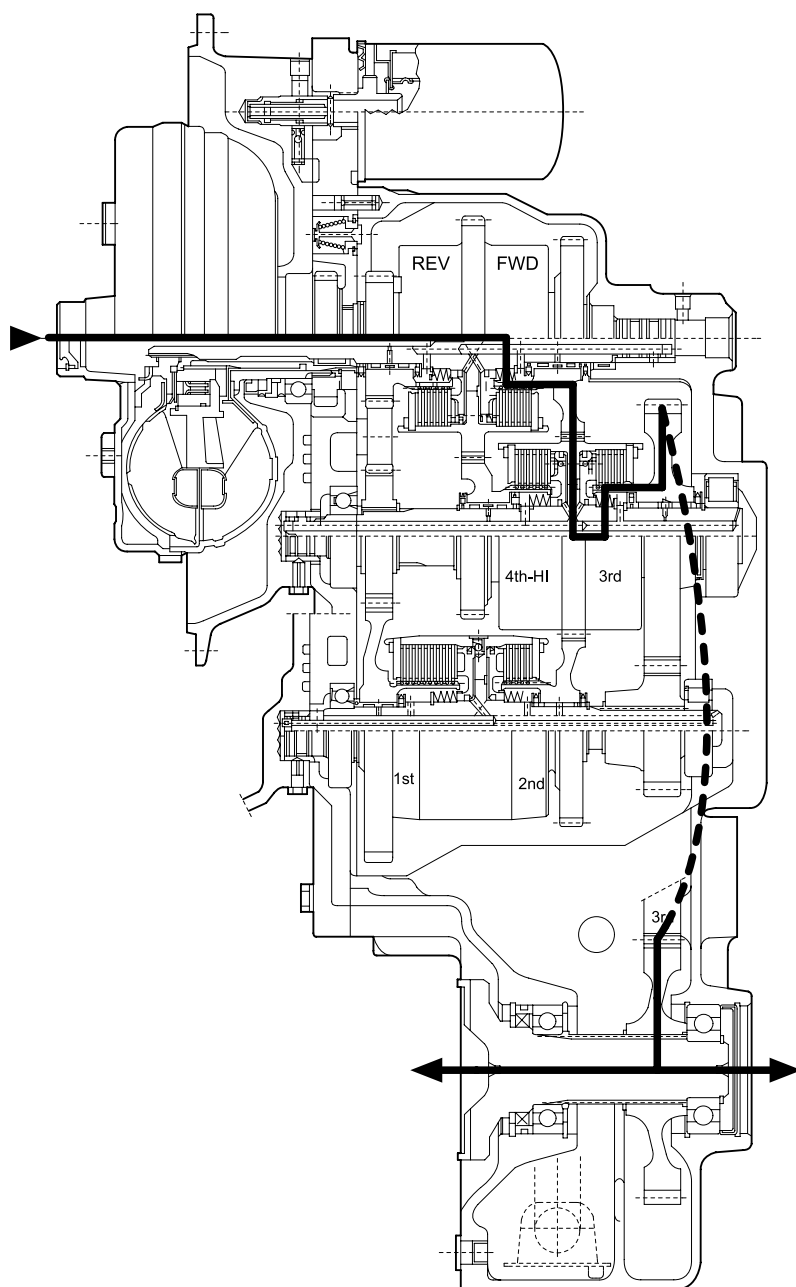
4th gear

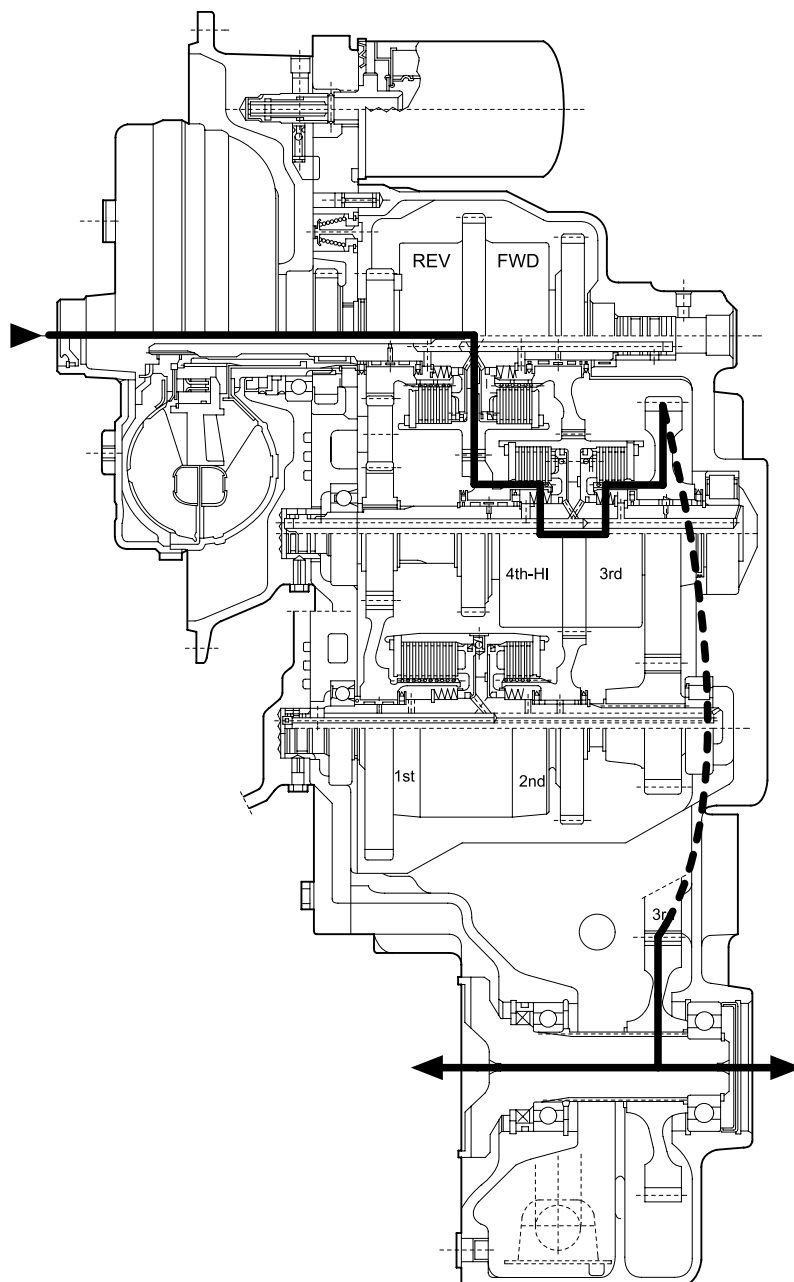




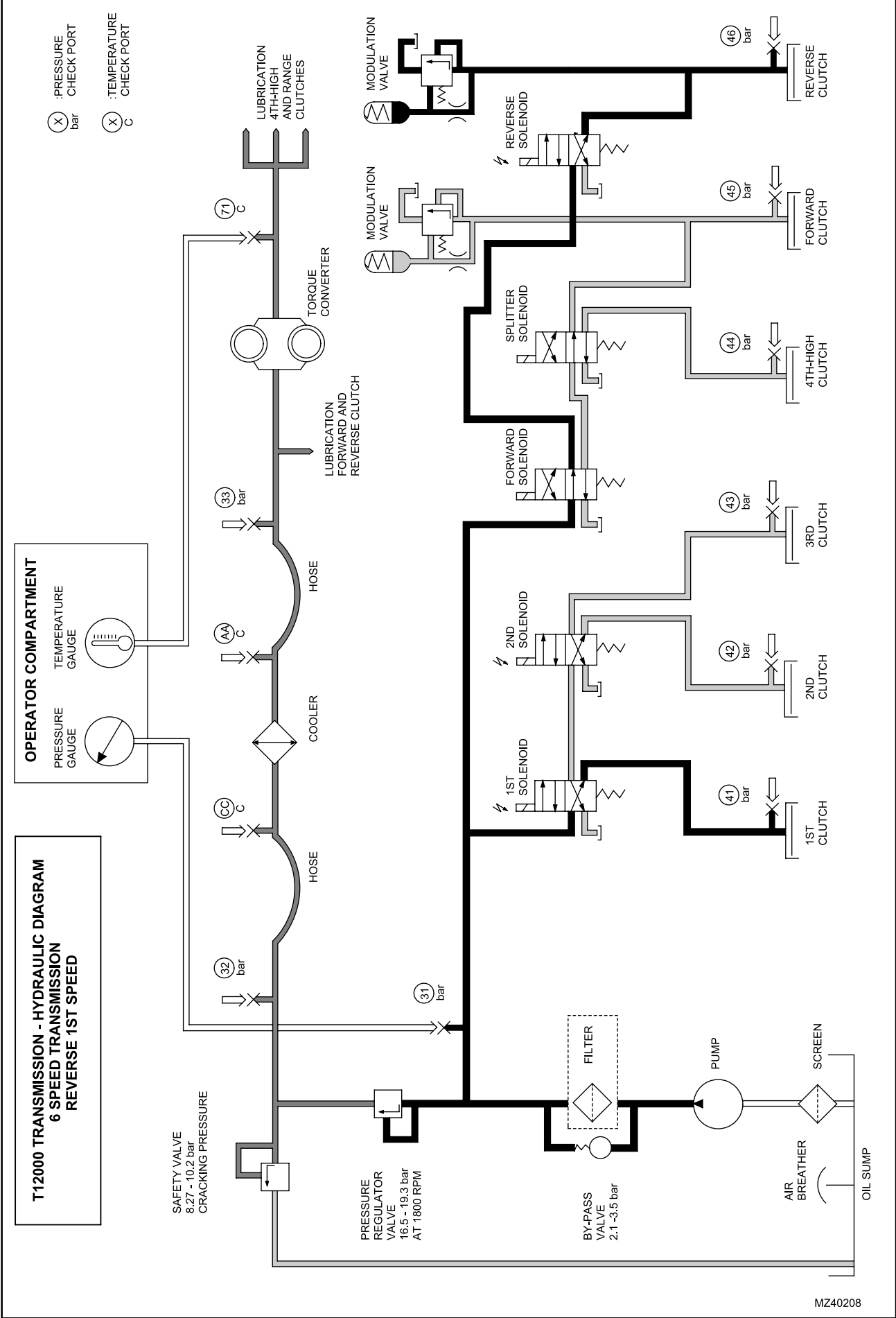
5th gear







Reverse gear



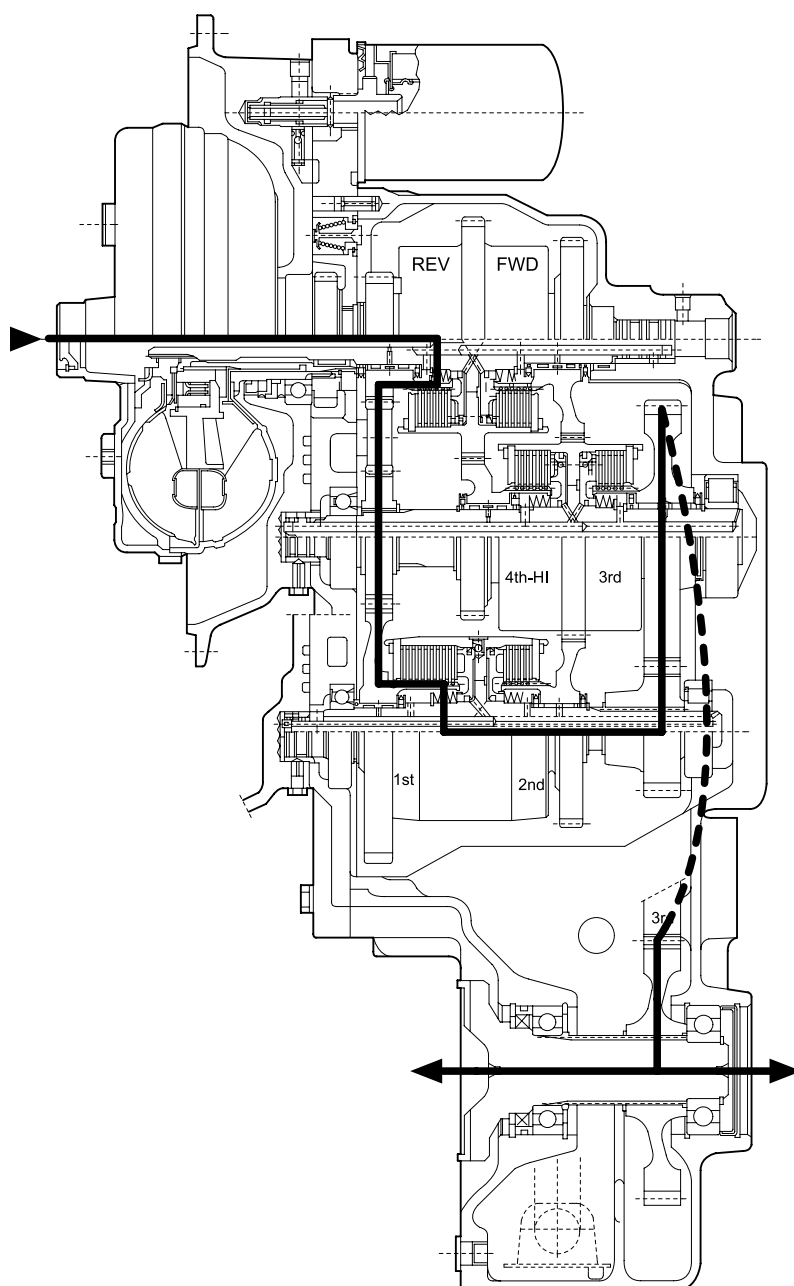
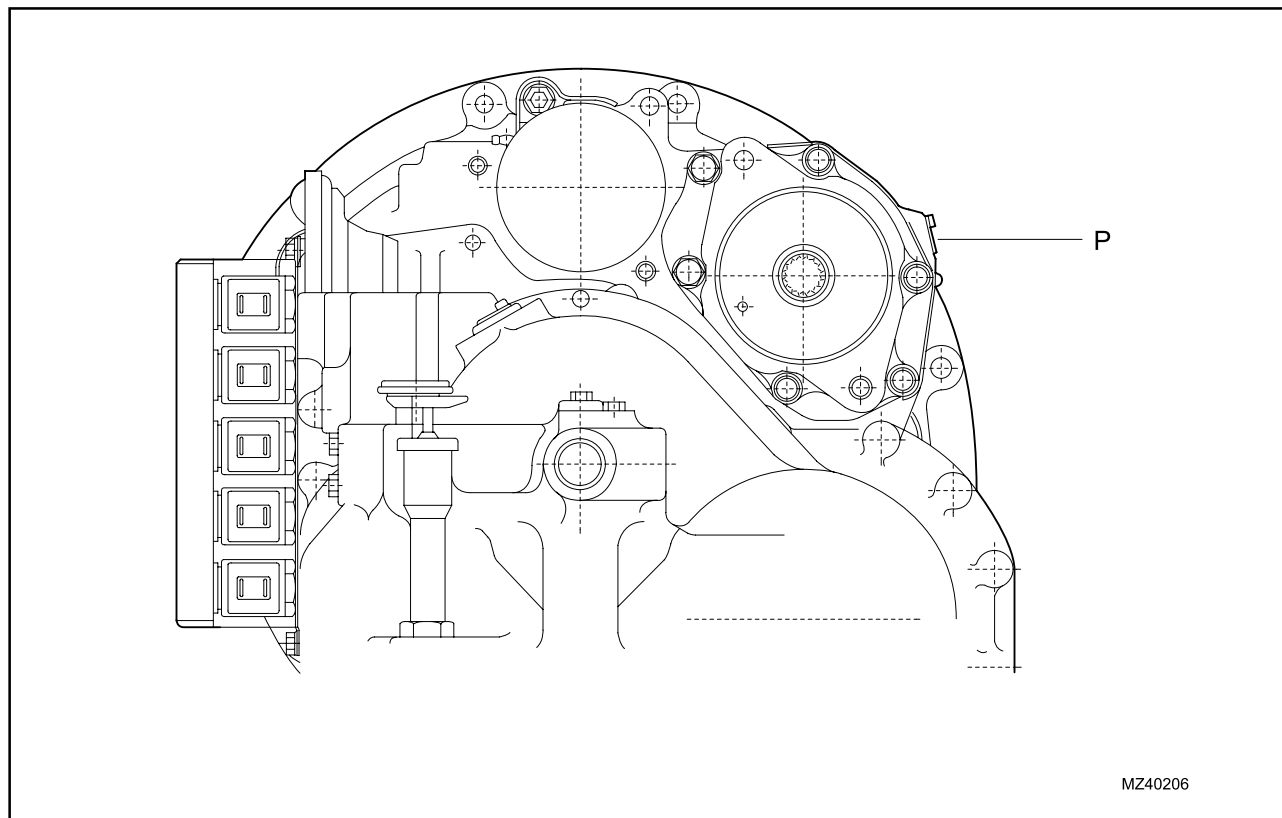


Table for gears R3 and R5

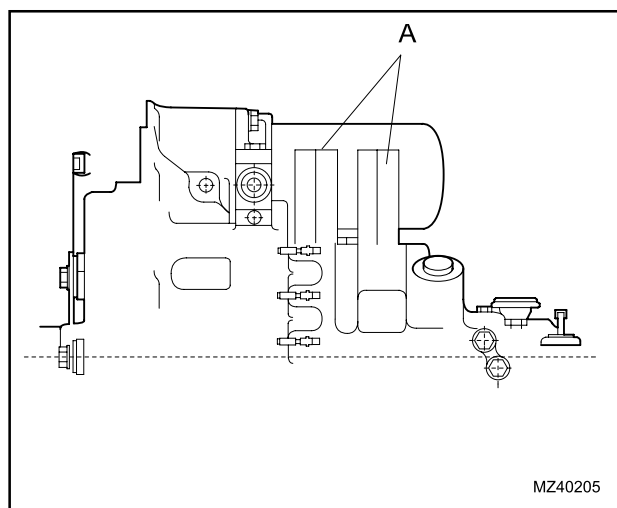
Gear selection	Active EMV	Active Clutch
R3	Reverse and 2nd	Reverse and 2nd
R5	Reverse	Reverse and 3rd

Gearbox pump



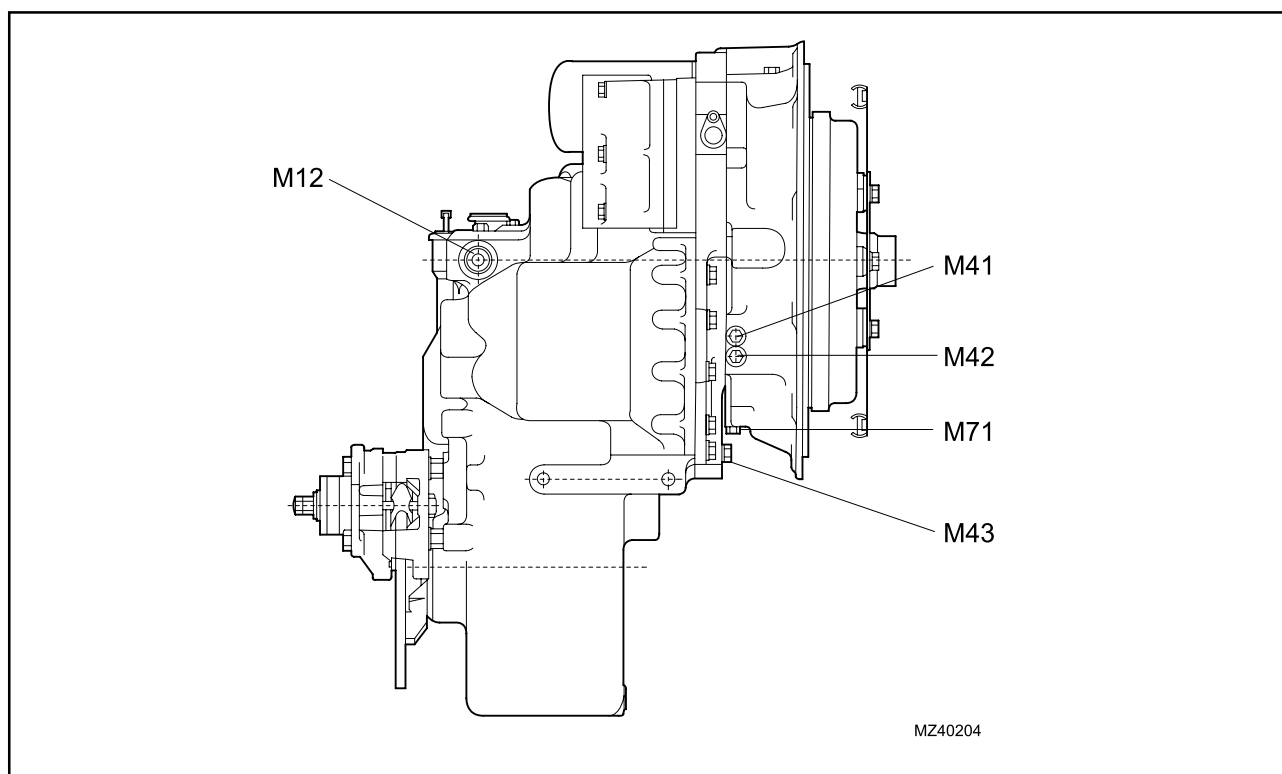
P Gearbox pump

Accumulator damping valves



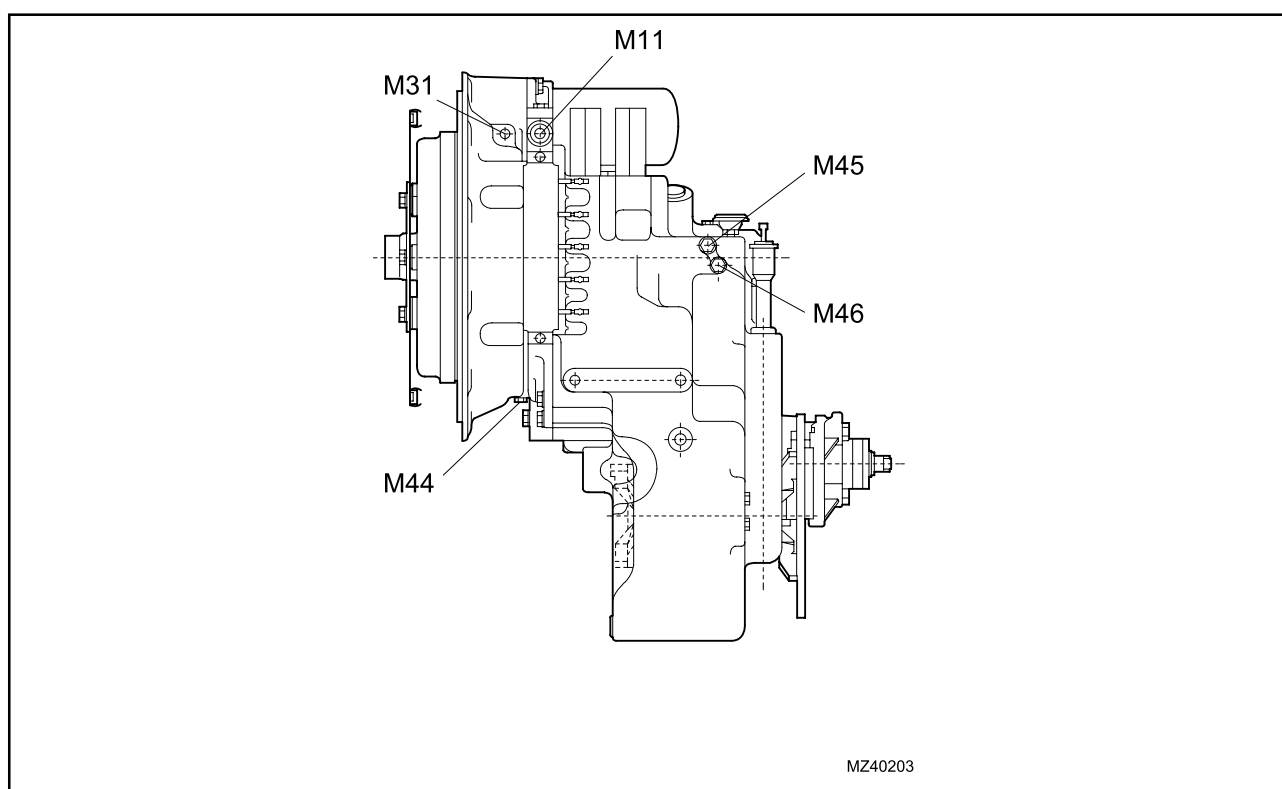
A Accumulator for clutch modulation

Test ports



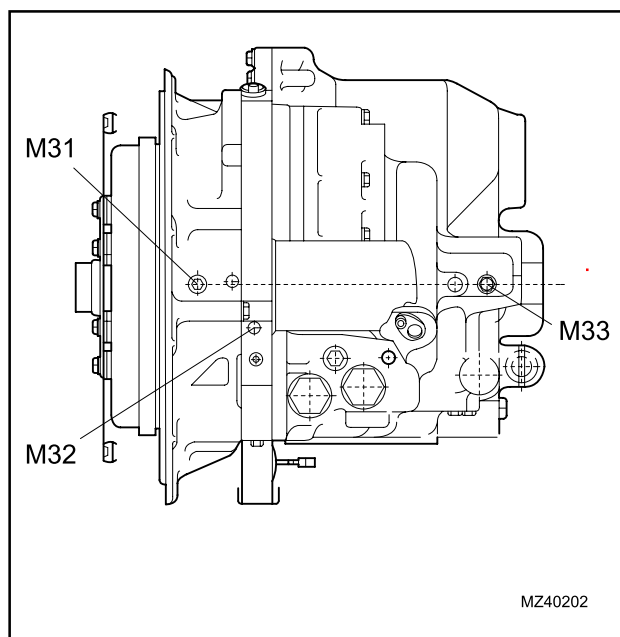
M12 From oil Cooler
M41 1st clutch pressure
M42 2nd clutch pressure

M71 Temperature test port
M43 3rd clutch pressure



M11 To cooler
M31 System pressure
M44 4th high pressure

M45 Forwards pressure
M46 Reverse pressure



M31 Clutch cooler
 M32 To oil cooler
 M33 From oil cooler

Test pressures

Port No	Function	Reading
M31	System Pressure	16.5 - 19.5 bar
M32	To oil cooler	2.9 - 6.4 bar
M33	From oil cooler	2.9 - 4.0 bar
M41	1st Clutch Pressure	16.5 - 19.5 bar
M42	2nd Clutch Pressure	16.5 - 19.5 bar
M43	3rd Clutch Pressure	16.5 - 19.5 bar
M44	4th High Pressure	16.5 - 19.5 bar
M45	Forwards Pressure	16.5 - 19.5 bar
M46	Reverse Pressure	16.5 - 19.5 bar
M71	Gearbox Temperature	70 - 120°C

NOTE: Use Minimes adapter Part No.2170068.0 (3/8 in. drive)

REMOVAL & INSTALLATION


Removal complete with engine

Refer to the engine removal procedure in the Engine Section and remove the transmission, complete with engine.

Removal from the engine

The following procedure details the removal of the transmission assembly, when the engine is installed in the machine. This procedure may also be used to remove the transmission assembly from an uninstalled engine, by disregarding the applicable steps.

1. Park the machine on firm level ground, apply the handbrake and chock the wheels.
2. Stop the engine and disconnect the battery.

CAUTION  Support the rear drive shaft clear of the transmission to make sure it is not damaged during removal.


3. Disconnect the rear drive shaft from the transfer box and support it clear of the transmission.
4. Disconnect the front drive shaft from the transfer box and front axle and remove the drive shaft from machine.
5. Drain the oil from the transmission oil cooler into a suitable container. Disconnect the inlet and outlet hoses from the gearbox and fit suitable blanks to the transmission and hoses.
6. Remove the hydraulic pump from the transmission and support it clear of the transmission.
7. Disconnect the speed sensor, oil temperature switch and the oil pressure switch from the transmission.

NOTE: Before disconnecting the solenoids, mark the wiring/plugs to prevent cross connections.

8. Disconnect the solenoid plugs from the APC connectors.
9. Remove the flywheel access plate on the engine.
10. Turn the engine flywheel and remove the eight bolts securing the flywheel to the converter drive plates.

NOTE: The rear engine/transmission to chassis mounting brackets are attached to the transmission. The engine must be supported before these are removed.

11. Support the engine using a suitable lifting sling.
12. Remove the two bolts securing the transmission to chassis mounting brackets.

CAUTION  The transmission weighs 175kg. Make sure you support the transmission with a suitable stand or lifting gear, before you remove the engine to transmission attachment bolts. Note that the transmission may rotate when disengaged from the engine.

14. Remove the engine to transmission attachment bolts and carefully disengage transmission from engine.
15. Remove transmission from machine and place on a suitable support or workbench.

Installation

The installation procedure is the reverse of the applicable removal procedure.

1. Make sure the engine flywheel and nose pilot bore are clean and free from burrs.
2. Use locating studs in the converter drive plates to align plates to flywheel.
3. Make sure the gearbox is accurately aligned with the engine.
4. Torque load bolts as follows:

Flywheel to converter 35-36 Nm (26-29 lbf ft)

Engine to gearbox 45-65 Nm (33-48 lbf ft)

Drive shaft to axle 63 Nm (47 lbf lb)

Drive shaft to transfer box 40 Nm (30 lbf ft)

Hydraulic pump to transmission 85-125 Nm (63-92 lbf ft)

5. Prime the gearbox and oil cooler with oil at engine tickover speed then make sure the oil level is correct before testing the gearbox.

Dismantling - Transmission

Figure 1
Side view of T12000 intermediate drop transmission.



Figure 4
Remove torque converter plug retainer ring.



Figure 2
Rear view showing electric control (disc brake not fitted to Targo).



Figure 5
Remove plug and O-ring.



Figure 3
Remove drive plate attaching cap head screws and washers. Remove drive plate and backing ring.



Figure 6
Remove torque converter to turbine shaft retainer ring.



Figure 7
Remove torque converter assembly.



Figure 10
Remove charging pump permanent hole cover (not used when auxiliary pump used).



Figure 8
Remove torque converter to shaft locating ring.



Figure 11
Remove pump mounting bolts and washers.
Remove pump and gasket.



Figure 9
Remove filter assembly.



Figure 12
Remove pressure regulator and regulator sleeve.
NOTE: Use special tool, see Figure 427.



Figure 13
Remove sensor port plug and O-ring.



Figure 16
Remove impeller hub gear.



Figure 14
Remove converter housing to transmission case bolts and washers.



Figure 17
Remove pump drive idler gear washer.



Figure 15
Remove converter housing and gasket.



Figure 18
Remove pump drive gear and bearing.



Figure 19
Remove pump drive idler shaft and washer.

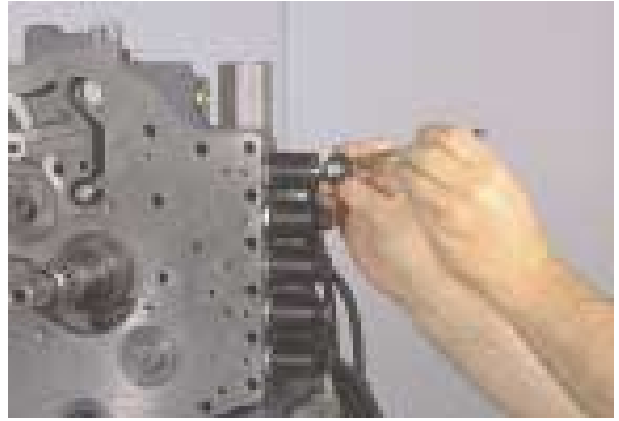


Figure 22
Remove solenoid valve cartridge retainer nut and O-ring.



Figure 20
Remove solenoid protection cover screws.



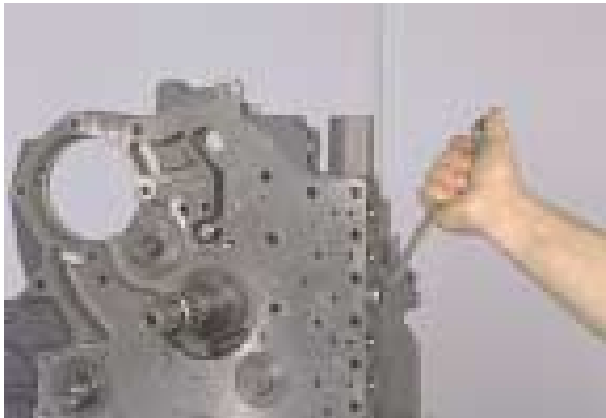
Figure 23
Remove solenoid coil and O-ring.



Figure 21
Remove solenoid protection cover.



Figure 24
Remove valve cartridge and O-ring.

**Figure 25**

Repeat procedures (Fig 22 thru 25) for remaining solenoid valves.

NOTE: A 3-speed will have a bore plug in the centre box. Remove bore plug.

**Figure 28**

Remove spacer plate and gasket.

**Figure 26**

Remove spacer plate bolts and washers.

**Figure 29**

Remove 1st and 2nd clutch assembly.

**Figure 27**

Pry spacer plate away from transmission case at dowel pin holes.

**Figure 30**

Remove forward and reverse clutch assembly.



Figure 31
Remove high and 3rd clutch assembly.
NOTE: A 3-speed will only have 3rd clutch.



Figure 34
Remove brake caliper assembly.
NOTE: Brake is not fitted to Targo.



Figure 32
Remove clutch shaft rear bearing outer races.



Figure 35
Turn front flange as shown. Remove retainer ring from ring groove and output flange from housing.



Figure 33
Remove brake disc assembly bolts from brake and housing.
NOTE: Brake is not fitted to Targo.



Figure 36
Remove output flange, oil seal sleeve and front bearing.



Figure 37
Remove bearing locating ring.



Figure 40
Flange removed.
NOTE: Brake is not fitted to Targo.



Figure 38
Remove output gear to shaft retainer ring.



Figure 41
Remove output gear.



Figure 39
Tap output shaft and flange from housing.



Figure 42
Remove flange oil seal sleeve retainer ring.



Figure 43
Remove sleeve and O-ring.



Figure 46
Remove modulator valve housing.



Figure 44
Remove output shaft rear bearing.



Figure 47
Remove inner, middle and outer springs. Remove valve stop pin and accumulator spool. Remove regulator spool and sleeve assembly.



Figure 45
Remove bearing locating ring.



Figure 48
Remove sensor hole plug and O-ring.



Figure 49
Remove dipstick and dipstick tube.



Figure 52
Remove tube retainer, screw, seal-washer, clip, washer and nut.



Figure 50
Remove air breather.



Figure 53
Remove supply tube O-ring.



Figure 51
Remove supply tube retainer screw.



Figure 54
Remove supply tube and screen assembly.

Dismantling - low 1st clutch



Figure 55
Remove oil sleeve distributor lock screw plug.
Remove lock screw.



Figure 58
Removed pilot bearing and sleeve.



Figure 56
Remove distributor sleeve using a hammer puller.



Figure 59
Remove clutch shaft oil sealing rings.



Figure 57
Remove sleeve and pilot bearing.



Figure 60
Remove front bearing using a bearing puller.



Figure 61
Remove outer thrust washer, bearing and inner thrust washer.



Figure 64
Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 62
Remove clutch gear and disc hub.



Figure 65
Remove clutch disc end plate retainer ring.



Figure 63
Remove clutch gear and pilot bearings.



Figure 66
Remove clutch disc end plate retainer ring.



Figure 67
Remove inner and outer clutch discs.



Figure 70
Remove retainer ring retainer.



Figure 68
Compress disc springs and remove retainer ring.



Figure 71
Remove disc spring.



Figure 69
Remove retainer ring.



Figure 72
Remove clutch piston wear plate.

**Figure 73**

Turn clutch over and tap shaft on a block of wood to remove clutch piston.

**Figure 76**

Remove inner race from shaft.

Dismantling - 2nd clutch

**Figure 74**

Remove clutch shaft rear bearing outer race.

**Figure 77**

Remove gear from shaft.

**Figure 75**

Remove gear and rear bearing inner race using a gear puller.

**Figure 78**

Remove gear locating ring from shaft.



Figure 79
Remove thrust bearing and clutch gear retainer ring.



Figure 82
Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 80
Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 83
Remove clutch disc and end plate retainer ring.



Figure 81
Remove clutch gear and hub and gear bearings.



Figure 84
Remove end plate.



Figure 85
Remove inner and outer clutch discs.



Figure 88
Remove retainer ring retainer.



Figure 86
Compress disc springs and remove retainer ring.



Figure 89
Remove disc springs.



Figure 87
Remove retainer ring.



Figure 90
Remove clutch piston wear plate.



Figure 91
Remove clutch piston.

Assembly - low 1st clutch



Figure 92
The two bleed valves in the clutch drum must be clean and free from foreign material.
Install clutch piston outer seal ring.



Figure 93
Install clutch piston inner seal ring.
NOTE: Ring must be sized before installing in clutch drum. Sizing is best done by rotating piston while holding a round object against the new seal ring as shown. Rotate piston until seal is flush with outer diameter of piston.



Figure 94
Position piston in low clutch drum. Use caution so as not to damage inner and outer piston sealing rings.



Figure 95
Position clutch piston wear plate on piston.



Figure 96
Install piston return disc springs. First spring with large diameter of bevel towards wear plate.
[Alternative seven (7) springs].
NOTE: The disc springs are to be used as complete assemblies and care should be taken not to mix the individual disc springs in another clutch or disc spring pack. Service replacement assemblies are banded together and must be replaced as an assembly.



Figure 97
Position return spring retainer on clutch shaft.



Figure 100
Install first steel outer clutch disc.



Figure 98
Start ring on shaft with snap ring pliers.



Figure 101
Install first friction (inner) clutch disc. Alternate steel and friction discs until ten (10) steel and ten (10) friction discs are in position.



Figure 99
Use a sleeve with the correct inner diameter to fit over shaft and against retainer ring. Strike the sleeve with a sharp blow, using a soft hammer, to compress the springs and seat the retainer ring. Make sure ring is fully seated in groove.



Figure 102
Install clutch disc end plate.



Figure 103
Install end plate retainer ring.



Figure 106
Position thrust bearing on clutch shaft against inner thrust bearing washer.



Figure 104
NOTE: Check low (1st) clutch pack disc clearance. Stand the clutch assembly on end. The clutch discs on the bottom will fall on to the end plate. Measure the distance between the clutch piston and the first steel disc using a feeler gauge or a taper gauge through the slots in the clutch drum and make sure between 0.080 - 0.135 in. (2.03 - 3.43 mm). If the clearance is greater than 0.135 in. (3.43 mm), add one steel disc under the end plate.



Figure 106
Install outer thrust bearing washer against bearing.



Figure 105
Position thrust bearing inner washer on clutch shaft.



Figure 108
Press bearings in clutch gear and disc hub, make sure bearings are pressed flush with face of gear on both sides.

**Figure 109**

Install clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Make sure the clutch hub is in full position in the clutch assembly. Do not force this operation.

**Figure 112**

Position outer thrust washer on shaft.

**Figure 110**

Position inner thrust washer on shaft.

**Figure 113**

Install clutch shaft front bearing.
NOTE: Bearing has a shield which must face up.

**Figure 111**

Position thrust bearing on shaft.

**Figure 114**

Install clutch shaft oil sealing rings. Grease seals to facilitate reassembly into front housing.

Assembly - 2nd clutch



Figure 115
Install inner and outer clutch piston seal rings. Refer to Figure 93 and size inner ring.



Figure 118
Install piston return disc springs. Make sure first spring with large diameter of bevel is towards wear plate. Alternate (5) springs. See NOTE on Fig. 96.



Figure 116
Position piston in clutch drum. Make sure piston sealing rings are not damaged.



Figure 119
Position return spring retainer on clutch shaft.



Figure 117
Install clutch piston wear plate.



Figure 120
Start ring on shaft with snap ring pliers.

**Figure 121**

Use a sleeve with the correct inner diameter to fit over shaft and against retainer ring. Strike the sleeve with a sharp blow, using a soft hammer, to compress the springs and seat the retainer ring. Make sure ring is fully seated in groove.

**Figure 124**

Install clutch disc end plate.

**Figure 122**

Install first steel (outer) clutch disc.

**Figure 125**

Install end plate retainer ring.

**Figure 123**

Install first friction (inner) clutch disc. Alternate steel and friction discs until five (5) steel and five (5) friction discs are in position.

**Figure 126**

Position thrust bearing inner washer on clutch shaft.



Figure 127
Position thrust bearing on clutch shaft against inner thrust bearing washer.



Figure 130
Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Make sure the clutch hub is in full position in the clutch assembly. Do not force this operation.



Figure 128
Install outer thrust bearing washer against thrust bearing.



Figure 131
Position thrust bearing inner washer on clutch shaft.



Figure 129
Press needle bearings in clutch gear and disc hub. Make sure bearings are pressed level with face of gear on both sides.



Figure 132
Position thrust bearing on clutch shaft against inner thrust bearing washer.



Figure 133
Install outer thrust bearing washer against bearing.



Figure 136
Install clutch shaft gear on clutch shaft with long hub of gear downwards.



Figure 134
Install thrust washer retainer ring.



Figure 137
Install rear bearing inner race on clutch shaft with bearing race shoulder downwards.



Figure 135
Install clutch shaft gear locating ring.



Figure 138
Position rear bearing on bearing race.

Dismantling - 4th high clutch

**Figure 139**

Remove clutch shaft oil sealing rings.

NOTE: The 4th clutch is only used on the 4 and 6 speed models.

**Figure 142**

Remove outer thrust washer retainer ring.

**Figure 140**

Remove first drive gear and front bearing using a gear puller.

**Figure 143**

Remove outer washer, thrust bearing and inner thrust washer.

**Figure 141**

Remove first drive gear locating ring.
For 3-speed models, proceed to Figure 155.

**Figure 144**

Remove clutch gear and disc hub.



Figure 145
Remove bearings and spacer from clutch gear.



Figure 148
Remove end plate.



Figure 146
Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 149
Remove clutch discs.



Figure 147
Remove end plate retainer ring.



Figure 150
Compress disc springs and remove retainer ring.



Figure 151
Remove retainer ring retainer.



Figure 154
Remove clutch piston.

Dismantling - 3rd clutch



Figure 152
Remove disc springs.



Figure 155
Remove clutch shaft rear bearing outer race.



Figure 153
Remove clutch piston wear plate.



Figure 156
Remove clutch gear and bearing inner race using a gear puller.



Figure 157
Remove clutch shaft rear bearing inner race.



Figure 160
Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 158
Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 161
Remove end plate retainer ring.



Figure 159
Remove clutch gear and hub and gear bearings.



Figure 162
Remove end plate.



Figure 163
Remove clutch discs.



Figure 166
Remove disc springs.



Figure 164
Compress disc springs and remove retainer ring.



Figure 167
Remove clutch piston wear plate.



Figure 165
Remove retainer ring retainer.



Figure 168
Remove clutch piston.

Assembly - 4th high clutch**Figure 169**

Make sure clutch piston bleed ball is clean and free from foreign material.

For 3-speed version, proceed to Figure 189.

**Figure 172**

Install piston return disc springs. First spring with large diameter of bevel towards wear plate.

Alternate five (5) springs. See NOTE on Fig 96.

**Figure 170**

Install inner and outer clutch piston seal rings. Refer to Figure 93 and size inner ring. Install clutch piston in clutch drum. Make sure seals are not damaged.

**Figure 173**

Install return spring retainer on clutch plate.

**Figure 171**

Install clutch piston wear plate.

**Figure 174**

Start ring on shaft with snap ring pliers.

**Figure 175**

Use a sleeve with the correct inner diameter to fit over shaft and against retainer ring. Strike the sleeve with a sharp blow, using a soft hammer, to compress the springs and seat the retainer ring. Make sure ring is fully seated in groove.

**Figure 178**

Install clutch disc end plate.

**Figure 176**

Install first steel (outer) clutch disc.

**Figure 179**

Install end plate retainer ring.

**Figure 177**

Install first friction (inner) clutch disc. Alternate steel and friction discs until six (6) steel and six (6) friction discs are in position.

**Figure 180**

NOTE: Check 4th (high) clutch pack disc clearance. Stand the clutch assembly on end. The clutch discs on the bottom will fall on to the end plate. Measure the distance between the clutch piston and the first steel disc using a feeler gauge or a taper gauge through the slots in the clutch drum and make sure between 0.048 - 0.108 in. (1.22 - 2.74 mm). If the clearance is greater than 0.108 in. (2.74 mm), add one steel disc under the end plate.



Figure 181
Position thrust bearing inner washer on clutch shaft.



Figure 184
Press one bearing in clutch gear. Install bearing spacer next to bearing. Press second bearing in gear, make sure bearings are flush with face of gear on both sides. Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Make sure the clutch hub is in fully engaged in the clutch assembly. Do not force this operation.



Figure 182
Position thrust bearing on clutch shaft against inner thrust bearing washer.



Figure 185
Position thrust washer on shaft.



Figure 183
Install outer thrust bearing washer against bearing.



Figure 186
Position thrust bearing on shaft.



Figure 187
Position thrust washer on shaft.



Figure 190
Position gear on clutch shaft.



Figure 188
Install thrust washer retainer ring.
NOTE: 3-speed clutch drum is not as shown.



Figure 191
Install clutch shaft front bearing. Make sure bearing shield faces upwards.



Figure 189
Install clutch shaft gear locating ring.



Figure 192
Install clutch shaft oil sealing rings. Grease rings to facilitate reassembly into front housing.

Assembly - 3rd clutch



Figure 193

Make sure clutch piston bleed ball is clean and free from foreign material.



Figure 196

Install piston return disc springs. First spring with large diameter of bevel towards wear plate. Alternate five (5) springs. See NOTE on Fig 96.



Figure 194

Install inner and outer clutch piston seal rings. Refer to Figure 93 and size inner ring. Install clutch piston in clutch drum. Make sure sealing rings are not damaged.



Figure 197

Position return spring ring retainer on clutch shaft.



Figure 195

Install clutch piston wear plate.



Figure 198

Start ring on shaft with snap ring pliers.

**Figure 199**

Use a sleeve with the correct inner diameter to fit over shaft and against retainer ring. Strike the sleeve with a sharp blow, using a soft hammer, to compress the springs and seat the retainer ring. Make sure ring is fully seated in groove.

**Figure 202**

Install clutch disc end plate.

**Figure 200**

Install first steel (outer) clutch disc.

**Figure 203**

Install end plate retainer ring.

**Figure 201**

Install first friction (inner) clutch disc. Alternate steel and friction discs until five (5) steel and five (5) friction discs are in position.

**Figure 204**

Position thrust bearing inner washer on clutch shaft.



Figure 205
Position thrust bearing on clutch shaft against inner thrust bearing washer.



Figure 208
Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Make sure the clutch hub is fully engaged in the clutch assembly. Do not force this operation.



Figure 206
Install outer thrust bearing washer against thrust bearing.



Figure 209
Position thrust bearing inner washer on clutch shaft.



Figure 207
Press needle bearings in clutch gear and disc hub. Make sure bearings are pressed flush with face of gear on both sides.



Figure 210
Position thrust bearing on clutch shaft against inner thrust bearing washer.

Dismantling - reverse clutch

**Figure 211**

Install outer thrust bearing washer against thrust bearing.

**Figure 212**

Install clutch shaft rear bearing inner race.

**Figure 213**

Install clutch shaft rear bearing outer race.

**Figure 214**

Remove outer thrust washer, thrust bearing and inner thrust washer.

NOTE: A 3-speed transmission will not have external gear teeth on the forward and reverse clutch drum.

**Figure 215**

Remove clutch gear and disc hub.

**Figure 216**

Remove bearings and spacer from clutch gear.



Figure 217
Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 220
Remove clutch discs.



Figure 218
Remove end plate retainer ring.



Figure 221
Compress disc springs and remove retainer ring.



Figure 219
Remove end plate.



Figure 222
Remove retainer ring retainer.

Dismantling - forward clutch



Figure 223
Remove disc springs.



Figure 226
Remove clutch shaft oil sealing rings.



Figure 224
Remove clutch piston wear plate.



Figure 227
Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 225
Remove clutch piston.



Figure 228
Remove clutch gear and disc hub.



Figure 229
Remove bearings and spacer from clutch gear.



Figure 232
Remove end plate.



Figure 230
Remove outer thrust washer, thrust bearing and inner thrust washer.



Figure 233
Remove clutch discs.



Figure 231
Remove end plate retainer ring.



Figure 215
Compress disc springs and remove retainer ring.



Figure 235
Remove retainer ring retainer.



Figure 238
Remove clutch piston.

Assembly - forward clutch



Figure 236
Remove disc springs.



Figure 239
Make sure clutch piston bleed orifice is clean and free from foreign material.



Figure 237
Remove clutch piston wear plate.



Figure 240
Install inner and outer clutch piston sealing rings. Refer to Figure 93 and size inner ring. Install clutch piston in clutch drum. Make sure sealing rings are not damaged.



Figure 241
Install clutch piston wear plate.



Figure 244
Start ring on shaft with snap ring pliers.



Figure 242
Install piston return disc springs. First spring with large diameter of bevel towards wear plate. Alternate five (5) springs. See NOTE on Fig 96.



Figure 245
Use a sleeve with the correct inner diameter to fit over shaft and against retainer ring. Strike the sleeve with a sharp blow, using a soft hammer, to compress the springs and seat the retainer ring. Make sure ring is fully seated in groove.



Figure 243
Position return spring ring retainer on clutch shaft.



Figure 246
Install first steel (outer) clutch disc.

**Figure 247**

Install first friction (inner) clutch disc. Alternate steel and friction discs until six (6) steel and six (6) friction discs are in position.

**Figure 250**

NOTE: Check forward clutch pack disc clearance. Stand the clutch assembly on end. The clutch discs on the bottom will fall on to the end plate. Measure the distance between the clutch piston and the first steel disc using a feeler gauge or a taper gauge through the slots in the clutch drum and make sure between 0.048 - 0.108 in. (1.22 - 2.74 mm). If the clearance is greater than 0.108 in. (2.74 mm), add one steel disc under the end plate.

**Figure 248**

Install clutch disc end plate.

**Figure 251**

Position thrust bearing inner washer on clutch shaft.

**Figure 249**

Install end plate retainer ring.

**Figure 252**

Position thrust bearing on clutch shaft against inner thrust bearing washer.

**Figure 253**

Install outer thrust bearing washer against thrust bearing.

**Figure 256**

Position thrust bearing on shaft.

**Figure 254**

Press one bearing in clutch gear. Install bearing spacer next to bearing. Press second bearing in gear, make sure bearings are flush with face of gear on both sides. Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Make sure the clutch hub is fully engaged in the clutch assembly. Do not force this operation.

**Figure 257**

Position outer thrust washer on shaft.

**Figure 255**

Position inner thrust washer on shaft.

**Figure 258**

Install clutch shaft oil sealing rings. Grease rings to facilitate reassembly into front housing.

Assembly - reverse clutch**Figure 259**

Make sure clutch piston bleed orifice is clean and free from foreign material.

**Figure 262**

Install piston return disc springs. First spring with large diameter of bevel towards wear plate. Alternate five (5) springs.

**Figure 260**

Install inner and outer clutch piston seal rings. Refer to Figure 93 and size inner ring. Install clutch piston in clutch drum. Make sure sealing rings are not damaged.

**Figure 263**

Position return spring retainer on clutch shaft.

**Figure 261**

Install clutch piston wear plate.

**Figure 264**

Start ring on shaft with snap ring pliers.

**Figure 265**

Use a sleeve with the correct inner diameter to fit over shaft and against retainer ring. Strike the sleeve with a sharp blow, using a soft hammer, to compress the springs and seat the retainer ring. Make sure ring is fully seated in groove.

**Figure 268**

Install clutch disc end plate.

**Figure 266**

Install first steel (outer) clutch disc.

**Figure 269**

Install end plate retainer ring.

**Figure 267**

Install first friction (inner) clutch disc. Alternate steel and friction discs until six (6) steel and six (6) friction discs are in position.

**Figure 270**

NOTE: Check forward clutch pack disc clearance. Stand the clutch assembly on end. The clutch discs on the bottom will fall on to the end plate. Measure the distance between the clutch piston and the first steel disc using a feeler gauge or a taper gauge through the slots in the clutch drum and make sure between 0.048 - 0.108 in. (1.22 - 2.74 mm). If the clearance is greater than 0.108 in. (2.74 mm), add one steel disc under the end plate.



Figure 271
Position thrust bearing inner washer on clutch shaft.



Figure 274
Press one bearing in clutch gear. Install bearing spacer next to bearing. Press second bearing in gear, make sure bearings are flush with face of gear on both sides. Install the clutch gear in the clutch assembly by aligning the clutch hub teeth with the clutch inner discs. Make sure the clutch hub is fully engaged in the clutch assembly. Do not force this operation.



Figure 272
Position thrust bearing on clutch shaft against inner thrust bearing washer.



Figure 275
Position inner thrust washer on shaft.



Figure 273
Install outer thrust bearing washer against bearing.



Figure 276
Position thrust bearing on shaft.



Figure 277
Position outer thrust washer on shaft.

Dismantling - regulator valve



Figure 278
Tap pin from regulator valve sleeve. Take care as valve spool is under spring pressure.



Figure 279
Remove regulator valve piston and pressure regulator valve spring.



Figure 280
Spring and piston removed.

Assembly - regulator valve



Figure 281
Position pressure regulator valve spring into regulator valve piston.



Figure 282
Install pressure regulator valve spring and regulator valve piston as an assembly into regulator valve sleeve.

**Figure 283**

Compress valve spring and valve and install pin into regulator valve sleeve.

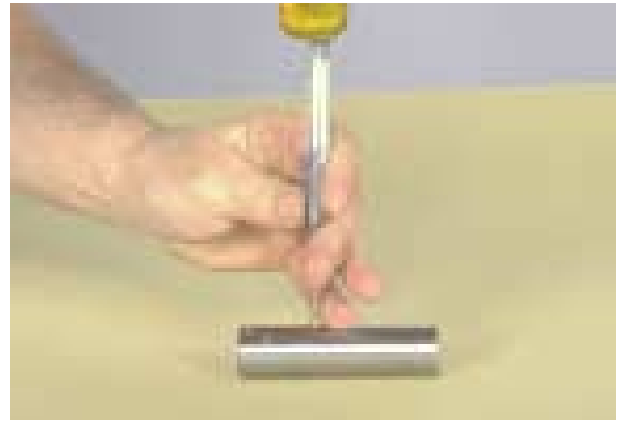
Dismantling - dual modulating valve

**Figure 284**

Remove inner, middle and outer spring and stop pin from modulator housing sleeve. Refer to Figure 47

**Figure 285**

Remove accumulator spool. Refer to Figure 47.

**Figure 286**

Remove cross pin from sleeve.

NOTE: Some units will have two cross pins the same length. Some units will have two cross pins of different lengths. The longest pin goes in the bottom hole.

**Figure 287**

Remove regulator spool, spring, retainer spring and spacer from housing sleeve.

Assembly - dual modulating valve

**Figure 288**

Install spring spacer in spring retainer.



Figure 289
Install spring in spring retainer.



Figure 292
Compress regulator spool and spring in sleeve far enough to install cross pin.



Figure 290
Inspect orifice and make sure clean and clear of any foreign material.



Figure 293
Install cross pin into sleeve.
NOTE: Some units will have two cross pins the same length. Some units will have two cross pins of different lengths. The longest pin goes in the bottom hole.



Figure 291
Install spring retainer, spring and regulator valve in sleeve against inner cross pin.



Figure 294
From opposite end, install accumulator spool in sleeve.



Figure 295
Install outer accumulator spring.



Figure 298
Install stop pin in inner spring.



Figure 296
Install middle spring.



Figure 299
If charging pump or pump drive gear are to be replaced, remove retainer ring and drive gear.

Dismantling - spacer plate



Figure 297
Install inner spring.



Figure 300
Remove reverse idler gear end plate cap head screw and washer.



Figure 301
Remove end plate and dowel pin.



Figure 304
Remove idler gear tapered thrust washer.



Figure 302
Remove reverse idler gear.



Figure 305
If reverse idler shaft is to be replaced, support spacer plate around idler shaft opening and press idler shaft from spacer.



Figure 303
Remove reverse idler gear bearing.



Figure 306
Idler shaft and locating ring removed.



Figure 307
Remove locating ring from idler shaft.



Figure 310
The stator support is held in place by two retaining rings. Remove converter end retainer ring from groove.



Figure 308
Tap pump drive idler shaft from spacer plate.



Figure 311
Push support towards transmission side far enough to expose retainer ring. Remove retainer ring.



Figure 309
Remove pump drive idler shaft and thrust washer.



Figure 312
From converter end, remove stator support and thrust washer.



Figure 313
Remove stator support oil sealing ring.



Figure 316
Compress converter safety valve spring and remove retaining washer.



Figure 314
Remove sealing ring expander ring.



Figure 317
Remove safety valve spring.



Figure 315
If support bushing or bearing is to be replaced, remove from stator support.



Figure 318
Turn spacer plate over and remove safety valve poppet.



Figure 319
Remove plug and seal washer from spacer plate.

Assembly - spacer plate



Figure 322
Compress spring and install poppet retaining washer.
NOTE: End of spring must go in recessed side of washer.



Figure 320
From transmission side of spacer plate, position converter safety valve poppet in bore of spacer.



Figure 323
Install plug and seal washer.



Figure 321
Turn spacer over and position safety valve spring on poppet.



Figure 324
If stator was removed, install bushing in support.
Install needle bearing in stator support.



Figure 325
Install stator support oil sealing ring expander ring.



Figure 328
Install stator support through washer and spacer plate.



Figure 326
Install oil sealing ring on expander ring.
NOTE: Expander spring gap is to be 180° from sealing ring hook joint.



Figure 329
Install stator support locating ring.



Figure 327
Position impeller hub gear washer on spacer plate.



Figure 330
Push support back through spacer until locating ring shoulders in support bore. Turn spacer plate over and install support retaining ring.



Figure 331
Position pump drive idler shaft on spacer plate.



Figure 334
Install locating ring on reverse idler shaft.



Figure 332
Position pump drive shaft through washer and into spacer plate. Align roll pin in spacer plate.



Figure 335
Support spacer plate and press reverse idler shaft into position and tight against locating ring.



Figure 333
Tap shaft into place.



Figure 336
Turn spacer plate over and position tanged thrust washer on shaft. Make sure tang in washer is in notch in spacer plate.



Figure 337
Position idler gear needle bearing on shaft. Lubricate bearing



Figure 340
Install end plate cap head screw and washer.



Figure 338
Position idler gear on bearing.



Figure 341
Tighten cap head screw to specified torque.

Assembly - front output flange



Figure 339
Position idler gear end plate and roll pin on idler shaft, aligning roll pin with hole in idler shaft.



Figure 342
Remove flange to bearing retainer ring.
NOTE: Do not remove expansion plug unless it is being replaced.



Figure 343
Remove bearing using a bearing puller.



Figure 346
Remove oil seal from sleeve.



Figure 344
Bearing removed.



Figure 347
Remove oil seal retainer ring from output flange.



Figure 345
Remove oil sleeve and O-ring.



Figure 348
Position bearing retainer ring on output flange.

**Figure 349**

Apply a very light coat of Permatex #2 to the outer diameter of the output flange oil seal, press oil seal in oil seal sleeve. Oil seal must be flush with one side of face of oil seal sleeve and lip of seal must be in.

**Figure 350**

Install new O-ring on oil seal sleeve. Position oil seal sleeve assembly on output flange.

NOTE: Recessed position of oil seal and sleeve must be up, with lip of seal up. This leaves a space between oil seal and output bearing.

**Figure 351**

Press bearing on output flange.

**Figure 352**

Install bearing to flange retainer ring.

Assembly - converter housing assembly

**Figure 353**

Remove torque converter bearing.

**Figure 354**

Remove oil distributor.



Figure 355
Remove converter oil seal.



Figure 358
Remove oil distributor sleeve (high and 3rd) using a hammer puller.



Figure 356
Remove converter housing plug (high and 3rd clutch shaft).



Figure 359
Sleeve removed.



Figure 357
Remove oil distributor sleeve set screw.



Figure 360
Remove converter housing plug (1st and 2nd clutch shaft).

Assembly - converter housing

Figure 361
Remove oil distributor sleeve set screw.



Figure 364
Apply a very light coat of Permatex #2 to the outer diameter of the converter housing oil seal. Press seal in housing with lip of seal in.



Figure 362
Remove oil distribution sleeve (1st and 2nd) using a hammer puller.



Figure 365
Install oil distributor in converter housing with long hub towards oil seal .



Figure 363
Sleeve removed.



Figure 366
Press converter bearing in housing against shoulder.

**Figure 367**

Install 1st and 2nd clutch shaft oil distributor sleeve in converter housing, with inside diameter chamfer up and the notch in the distributor aligned with the retaining set screw hole in the converter housing.

**Figure 368**

Apply Loctite #243 to threads of sleeve set screw.
NOTE: This screw has a hole in it. Do not allow any Loctite to plug hole.
Install set screw in converter housing and in oil distributor.

**Figure 369**

Install set screw plug.

**Figure 370**

Install high-3rd clutch shaft oil distributor sleeve in converter housing with inside diameter chamfer up and the notch in the distributor aligned up with the retaining set screw hole in the converter housing.

**Figure 371**

Apply Loctite #243 to threads of sleeve set screw.
NOTE: This screw has a hole in it. Do not allow any Loctite to plug hole.
Install set screw in converter housing and in oil distributor.

**Figure 372**

Install set screw plug.

Assembly - transmission



Figure 373

Install forward - reverse oil distributor sleeve in transmission case with inside diameter chamfer out (towards front of transmission) and the notch in the distributor aligned with the retaining set screw hole in the transmission case.



Figure 376

Install reverse and forward clutch shaft rear bearing in transmission case.



Figure 374

Apply Loctite #243 and install set screw in transmission case and in oil distributor sleeve.



Figure 377

Position a new O-ring on lower end of modulation valve sleeve and spring assembly. Install O-ring on other valve sleeve.



Figure 375

Install set screw plug.



Figure 378

Install valve (or valves) in transmission case.

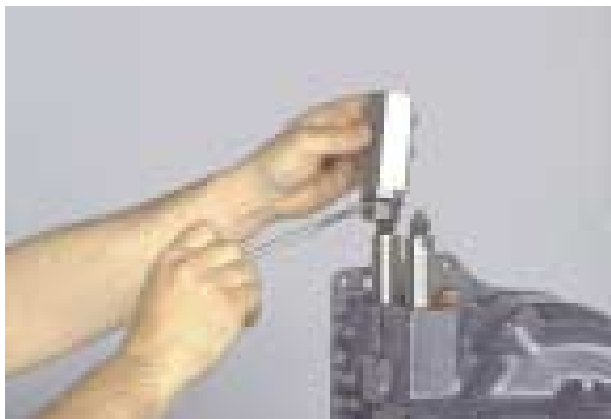


Figure 379
Position a new O-ring on modulator valve housing.



Figure 382
Push supply tube through opening in case and install O-ring.



Figure 380
Install housing over sleeve and spring assembly and tighten to 60 - 65 lbf ft. (81 - 88 Nm).



Figure 383
Install supply tube mounting screw, seal washer, clip, washer and nut. Tighten mounting screw securely (refer to Figure 384).



Figure 381
Position supply tube and screen assembly in transmission case sump.

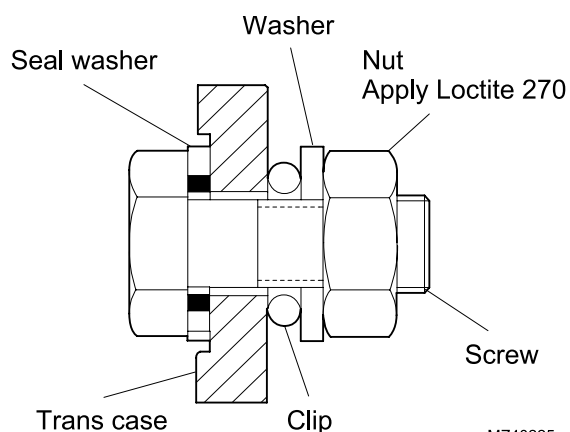


Figure 384

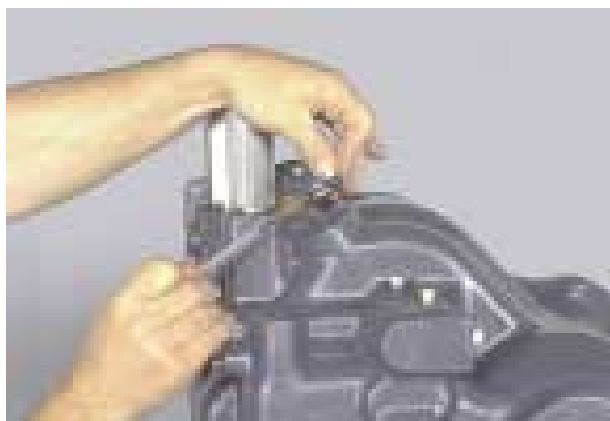


Figure 385
Install sensor hole plug and O-ring.



Figure 388
Install output shaft inner bearing locating ring in rear of transmission.



Figure 386
Install air breather.



Figure 389
Install rear bearing in case against locating ring.



Figure 387
Install dipstick tube and dipstick.



Figure 390
Install a new O-ring on rear oil seal sleeve.

**Figure 391**

Apply a very light coat of Permatex #2 to the outer diameter of the output flange oil seal. Press seal in oil seal sleeve. Oil seal must be flush with one side of face of oil seal sleeve and lip of seal must be in. Position oil seal sleeve in transmission case with recessed portion of oil seal towards output bearing. This leaves space between oil seal and bearing.

**Figure 394**

Install rear output flange and shaft through output oil seal. Align splines on shaft with splines on output gear. Install shaft through gear. Make sure oil seal is not damaged.

NOTE: Brake disc not fitted to Targo.

**Figure 392**

Install oil seal sleeve retainer ring.

**Figure 395**

Install output shaft to output gear retainer ring.

**Figure 393**

From front of transmission case, position output gear with long hub of gear towards front.

**Figure 396**

Install front output shaft bearing locating ring.

**Figure 397**

Position front output flange and bearing assembly on output shaft. Using snap ring pliers, squeeze ends together and tap flange assembly into case until snap ring can seat in snap ring groove.

**Figure 400**

Install forward and reverse clutch assembly.

**Figure 398**

Install high and 3rd clutch shaft rear bearing outer race.

**Figure 401**

Install 1st and 2nd clutch shaft rear bearing outer race.

**Figure 399**

Install high and 3rd clutch assembly.

**Figure 402**

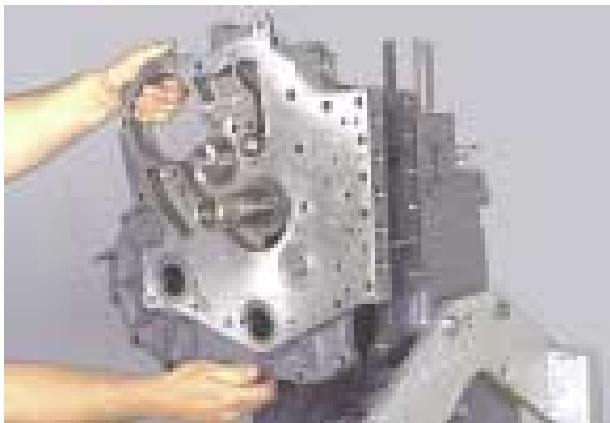
Install 1st and 2nd clutch assembly.

**Figure 403**

Position new transmission case to converter housing gasket on transmission case. A light coat of grease will hold gasket in position.

**Figure 406**

Position impeller hub gear on stator support.

**Figure 404**

Install spacer plate assembly on transmission, aligning clutch shaft with openings in spacer plate. Take care not to damage oil sealing rings.

**Figure 407**

Install pump idler gear bearing on idler shaft.

**Figure 405**

Spacer plate must be tight against transmission case. Do not use bolts to pull spacer plate and case together. Tap spacer plate into position at dowel pins. Install spacer plate to transmission case capscrews. Tighten cap head screws to specified torque.

**Figure 408**

Install pump idler on bearing.

**Figure 409**

Install idler gear thrust washer, aligning hole with roll pin.

**Figure 412**

Tighten cartridges to specified torque.

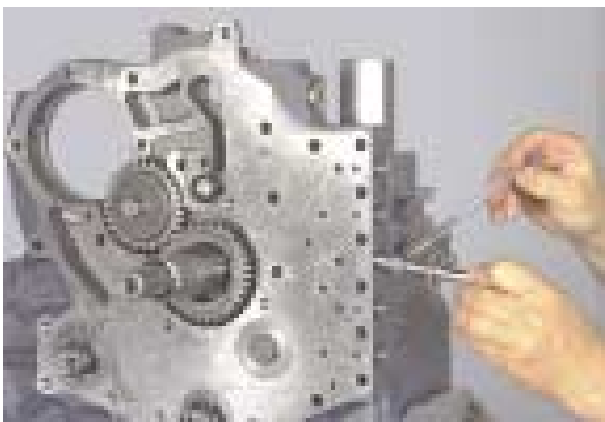
Assembly - electric control

**Figure 410**

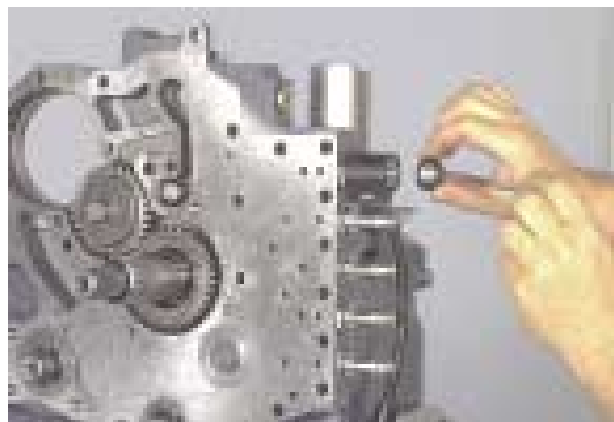
Install bore plug and O-rings in centre hole on 3-speed transmissions only.

**Figure 413**

With cartridge to coil O-ring in place, position solenoid coil on cartridge.

**Figure 411**

With O-rings in position, install solenoid cartridges.

**Figure 414**

With new O-rings in position, install coil to cartridge nut. Tighten nut as per assembly instruction drawing.

**Figure 415**

Install solenoid protection cover and mounting screws. Torque tighten screws to specified torque.

Assembly - transmission

**Figure 418**

Install converter housing to transmission case screws and lockwashers.

**Figure 416**

Position spacer to converter housing gasket on spacer. A light coat of grease will hold gasket in place.

**Figure 419**

Torque tighten bolts to specified torque.

**Figure 417**

Use aligning screws to facilitate converter housing to spacer installation. The transmission could be laid down to align the end of the clutch shafts into sealing ring sleeves in converter housing. Do not force this operation. Converter housing must be tight against transmission spacer.

NOTE: Do not use bolts to pull converter housing into place.

**Figure 420**

Install converter locating ring on turbine shaft.



Figure 421
Position converter assembly on stator support and turbine shaft.



Figure 424
Install bore plug retainer ring.



Figure 422
Install converter assembly retainer ring.



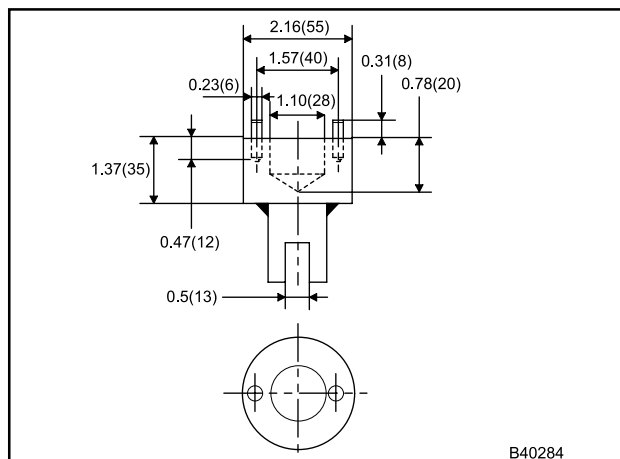
Figure 425
Install sensor hole plug end O-ring.



Figure 423
With new O-ring in place, install bore plug in converter assembly.



Figure 426
Install regulator sleeve assembly in converter housing.

**Figure 427**

Using a special tool, tighten sleeve to 40 - 45 lbf ft. (61.1 - 67.7 Nm).

**Figure 430**

Install charging pump to converter housing bolts and washers and tighten to specified torque.

**Figure 428**

Position new charging pump to converter housing gasket.

**Figure 431**

If auxiliary pump is used, it is not necessary to install the permanent pump hole cover. With a new gasket in place, install pump hole cover on charging pump. Install bolts and washers and tighten to specified torque.

**Figure 429**

Install charging pump in converter housing.

**Figure 432**

Install oil filter on regulating valve. Tighten filter to 20 - 25 lbf ft. (27 - 34 Nm). If brake is not used, proceed to Figure 436.

**Figure 433**

Position caliper brake assembly on brake disc.

**Figure 436**

Measure the bolt circle diameter and make sure the correct drive plate kit is fitted.

Align small holes in drive plates. Position drive plate and weld nut assembly on torque converter. Align intermediate drive plates and backing plate with holes in torque converter assembly.

NOTE: Two dimples 180° apart in backing ring must be out towards engine flywheel (hollow side facing torque converter assembly).

Install cap head screws and tighten to 26 - 29 lbf ft. (35 - 39 Nm).

**Figure 434**

Install caliper brake mounting screw through brake assembly and through lock nut. Apply Loctite #262 to threads and install screw in transmission case.

**Figure 435**

Mounting screws are installed to allow free movement of caliper pads to disc. Tighten lock nut.

TROUBLESHOOTING

The following information is given as a guide to isolating and determining the specific problem area in a transmission that is not functioning correctly.

When troubleshooting a transmission problem, it should be kept in mind that the transmission is only the central unit of a group of related powertrain components. Proper operation depends on the condition and correct functioning of the other components of the group. Therefore, to properly diagnose a suspected problem in the transmission, it is necessary to consider the transmission fluid, charging pump, torque converter, transmission assembly, oil cooler, filter, connecting lines and controls, including the engine, as a complete system.

By analysing the principles of operation together with the information in this section, it should be possible to identify and correct any malfunction that may occur in the system.

Transmission

The T1200 (powershift with torque converter transmission) troubles fall into three general categories:

1. Mechanical problems.
2. Hydraulic problems.
3. Electrical problems.

In addition to the mechanical and electrical components, all of which must be serviceable and functioning correctly, the correct functioning of the hydraulic circuit is most important. Transmission fluid is the life blood of the transmission. It must be supplied in an adequate quantity and delivered to the system at the correct pressures to ensure converter operation, to engage and hold the clutches from slipping and to cool and lubricate the working components.

Procedures


Stall test

A stall test identifies transmission, converter or engine problems.

Use the following procedure:

1. Put the machine against a solid barrier, such as a wall and chock the wheels.
2. Put the directional control lever in FORWARD (or REVERSE as applicable).
3. Select the highest speed.

With the engine running, slowly increase engine speed to approximately half throttle and hold until transmission (converter outlet) temperature reaches the operating range.

CAUTION  *Do not operate the converter at stall condition longer than 30 seconds at one time. Shift to neutral for 15 seconds and repeat the procedure until the desired temperature is reached. Excessive temperature, 120°C (250°F), maximum will cause damage to transmission clutches, fluid, converter and seals.*

Transmission pressure checks

Transmission problems can be isolated by the use of pressure tests. When the stall test indicates slipping clutches, then measure clutch pack pressure to determine if the slippage is due to low pressure or clutch plate friction material failure.

Converter charging pressure and transmission lubrication pressure can also be measured.

Mechanical and electrical checks

Before checking any part of the system for hydraulic function (pressure testing), the following mechanical and electrical checks should be made:

- Check the parking brake and inching pedal for correct adjustment.
- Make sure all lever linkage is properly connected and adjusted in each segment and at all connecting points.
- The controls are actuated electrically. Check the wiring and electrical components.

- Make sure that all components of the cooling system are in good condition and operating correctly. The radiator must be clean to maintain the proper cooling and operating temperature for the engine and transmission. Air clean the radiator if necessary.
- The engine must be operating correctly. Make sure that it is correctly tuned and adjusted to the correct idle speed and maximum no-load governed speed specifications.

Hydraulic checks

Before checking the transmission clutches, torque converter, charging pump and hydraulic circuit for pressure and rate of oil flow, it is important to make the following transmission fluid check.

Check oil level in transmission. The transmission fluid must be at the correct (full level). All clutches and the converter and its fluid circuit lines must be fully charged (filled) at all times.

NOTE: The transmission must be at operating temperature of 82 - 93°C (180 - 200°F) to obtain correct fluid level and pressure readings. DO NOT attempt to make these checks with cold oil.

To raise the oil temperature to this specification it is necessary to either operate (work) the machine or run the engine with converter at 'stall' (Refer to stall test).

CAUTION *Make sure that the machine does not move unexpectedly when operating the engine and converter at stall speed.*



Troubleshooting guide

Refer to the following troubleshooting guide for the diagnosis of typical transmission problems.

Low clutch pressure

CAUSE	REMEDY
Low oil level	Fill to correct level
Clutch pressure regulating valve stuck open	Clean valve spool and housing
Faulty charging pump	Replace pump
Broken or worn clutch shaft or piston sealing rings	Replace sealing rings
Clutch piston bleed valve stuck open	Clean bleed valves thoroughly

Low charging pump output

CAUSE	REMEDY
Low oil level	Fill to correct level
Suction screen plugged	Clean suction pump
Defective charging pump	Replace pump

Overheating

CAUSE	REMEDY
Worn oil sealing rings	Remove, disassemble and rebuild converter assembly
Worn charging pump	Replace charging pump
Low oil level	Fill to correct level
Dirty oil cooler	Clean oil cooler
Restriction in oil cooler lines	Change oil cooler lines

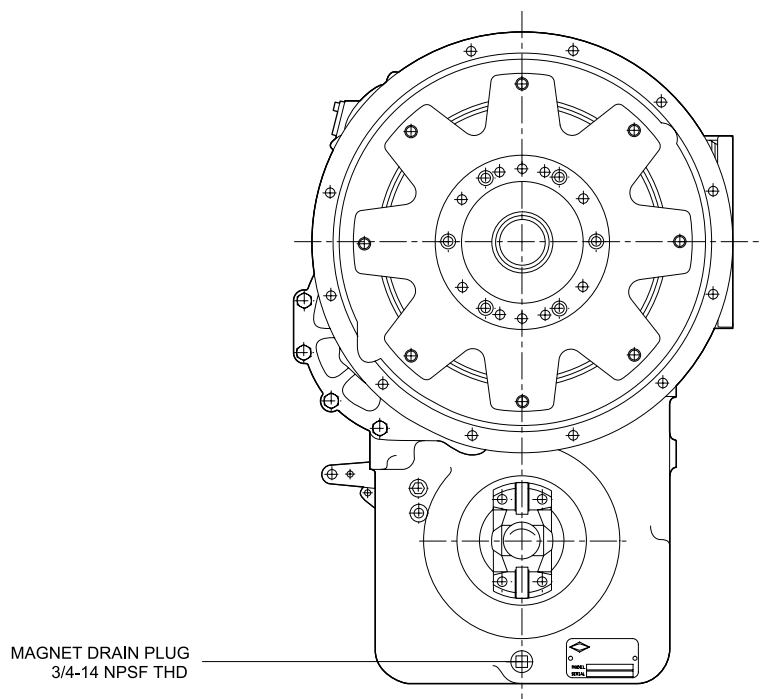
Noisy converter

CAUSE	REMEDY
Worn charging pump	Replace charging pump
Worn or damaged bearings	A complete dismantling will be necessary to determine which bearing is faulty

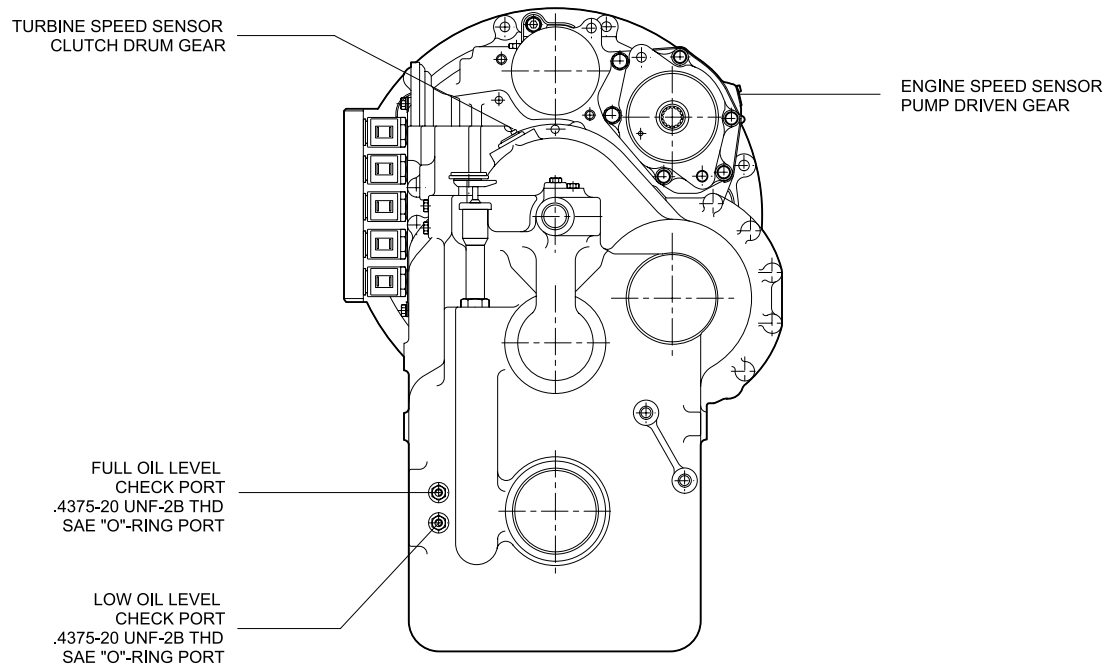
Lack of power

CAUSE	REMEDY
Low engine RPM at convertor stall	Tune engine check governor
See 'Overheating ' and make same checks	Make corrections as detailed in 'Overheating'

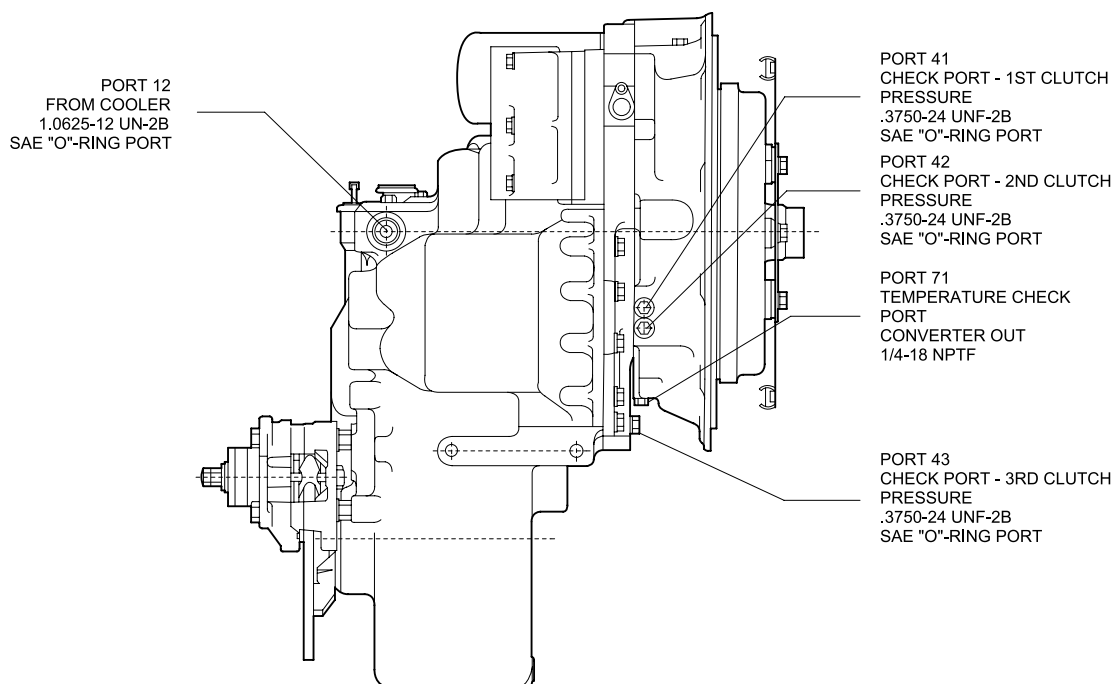
Check Ports



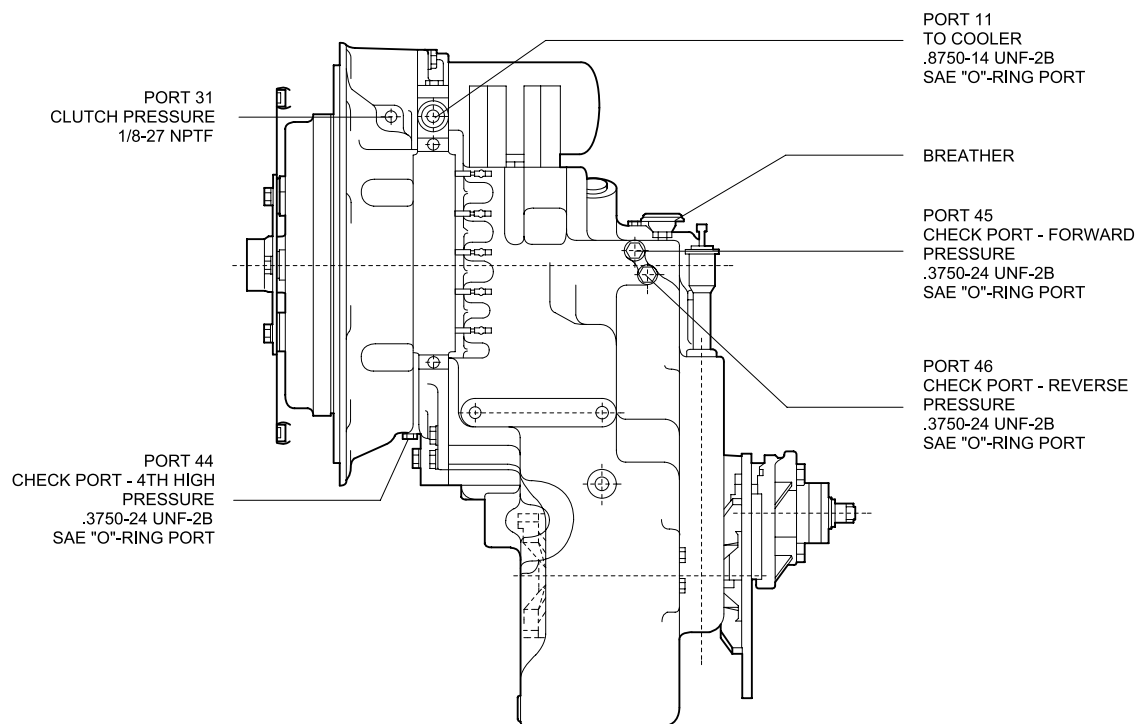
FRONT VIEW



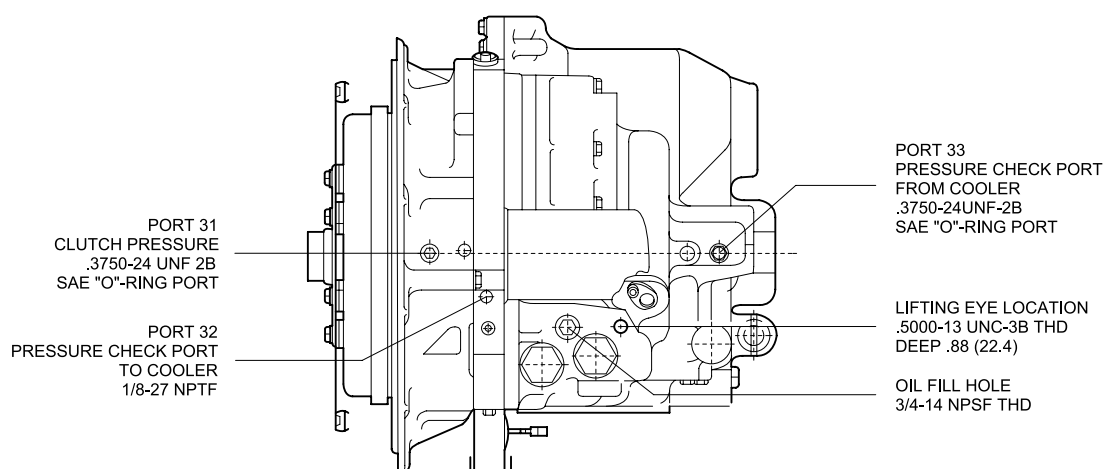
REAR VIEW



RIGHT SIDE VIEW

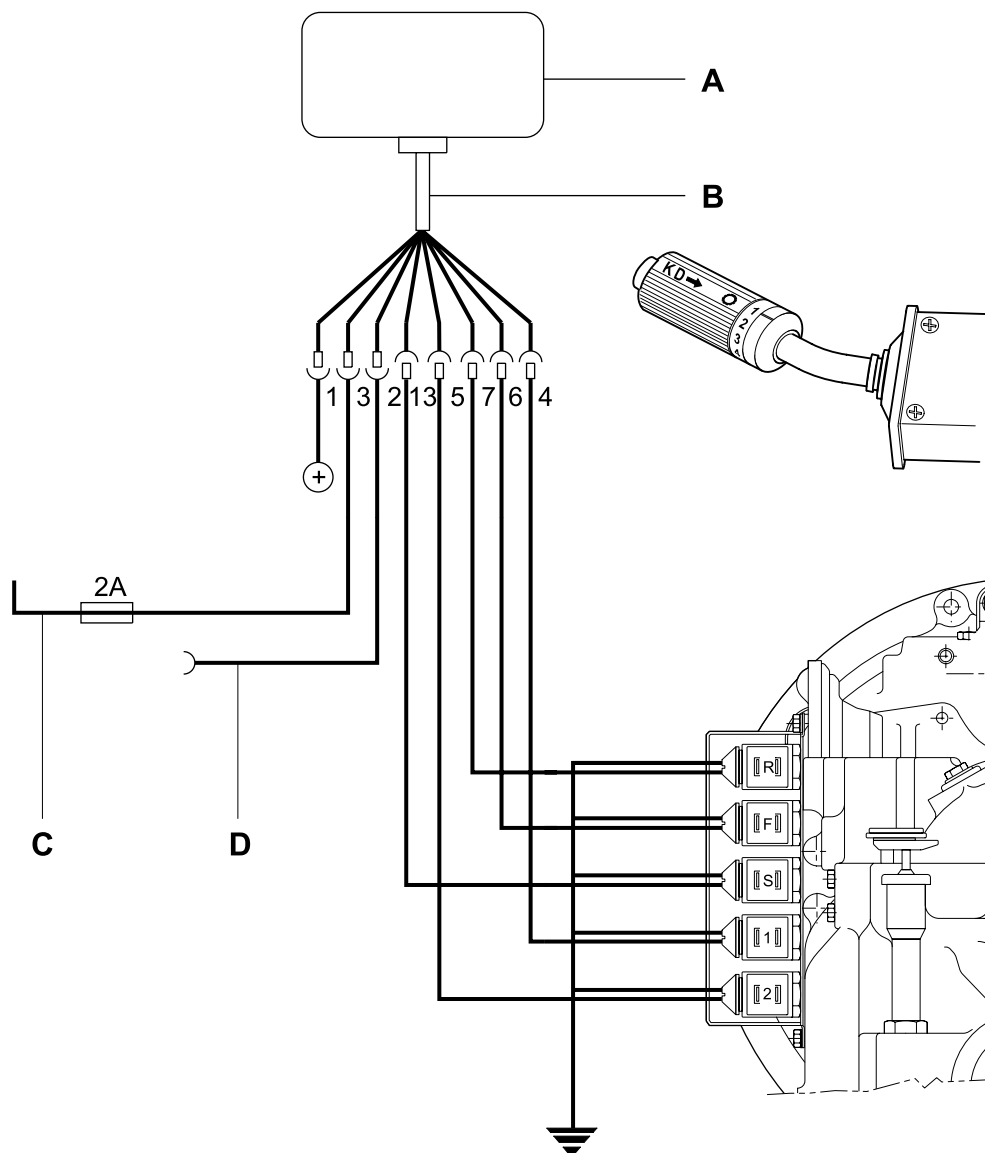


LEFT SIDE VIEW



MZ40229

Standard 6 speed transmission



- A Gearbox module
- B Max of 2A allowed per output
- C Not in use
- D Earth (-31)
- R Solenoid valve reverse
- F Solenoid valve F
- S Solenoid valve S
- 1 Solenoid valve 1
- 2 Solenoid valve 2
- 4 Pin 4 of the APC module
- 5 Pin 5 of the APC module
- 6 Pin 6 of the APC module
- 7 Pin 7 of the APC module
- 13 Pin 13 of the APC module

NOTE: Pins 8 to 12 (Not in use)

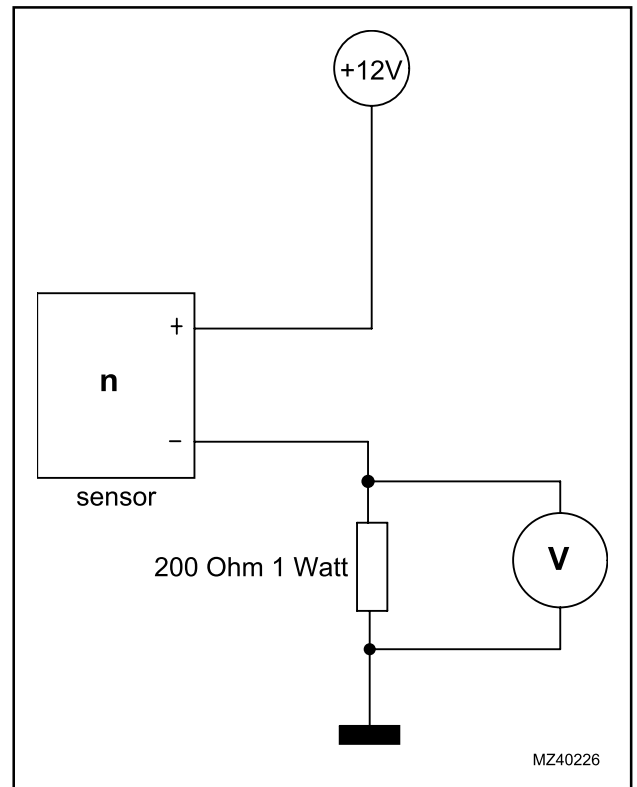
Speed sensor - static standalone test

In order to be able to sense the currents, a series resistor of e.g. 200 Ohms must be used. This resistor is integrated in the controller, but when the sensor is to be tested, it must be connected externally.

Connect the sensor to an external power source and measure the DC voltage across the series resistor.

The voltage reading should be either 1.2 - 1.6V (for the 7mA current level) or 2.6 - 3.0V (for the 14mA \pm 1mA current level).

If the teeth can be moved slowly, distinct toggling between the two levels should be noticed.



SECTION 4

BOOM

DESCRIPTION AND OPERATION

Description

The machine has a two section telescopic boom. Each section consists of a box section with the inner section moving inside the outer section.

WARNING *When operating the control valve using the manual controls, take care that you keep clear of any moving components.*



The boom is controlled using the 'Solo' control handle located in the cab. The boom can also be controlled manually from the control valve located at the rear of the boom, using the manual operating modules.

The inner section can be extended to any position from fully retracted to fully extended. The boom position is limited, depending on the weight being carried, boom angle and boom extension.

To prevent an overload, the machine is fitted with a forward stability indicator, located in the cab. The forward stability indicator gives a progressive indication of load on the rear axle to warn the operator when the machine is nearing its safe working load.

To ensure the inner section operates smoothly, non-metallic wear pads are fitted between the inner and outer sections, at the front of the outer boom and the rear of the inner boom. Two wear pads are also fitted at intervals along the outer boom.

The boom operations consist of:

- lift/lower
- extend/retract
- carriage crowd back/tip forward.

The carriage is fitted to the front of the inner boom section and carries the attachments. The attachments are secured to the carriage by a locking mechanism, which is either manually or hydraulically operated.

A pair of cassette trays are fitted inside the inner boom to house the hydraulic pipes for the crowd cylinder and the 1st auxiliary services.

OPERATION

The 'Solo' handle in the cab operates all boom services.

The carriage crowd cylinder is hydraulically connected to the compensator cylinder. Oil is transferred between the crowd and compensator cylinders during the lifting/lowering of the boom to make sure the carriage stays at the same angle to the ground throughout the arc of the lift. This works independently of the crowd function, which allows the carriage to be rolled forwards or backwards.

The extension cylinder is fitted inside the inner boom. The forward end is secured to the inner boom and the rear end is secured to the outer boom.

When the boom is operated, the hydraulic hoses for the front auxiliary services and the crowd cylinder are withdrawn from the cassette to allow the boom to extend.

The front auxiliary services are connected to a manifold on the left side of the inner boom drop-down link and are connected, by flexible pipes to the carriage.

A Joystick/Boom control isolator switch, in the cab, gives the following facilities:

- To prevent operation of the carriage locking pins when attachments are fitted to the carriage
- To prevent all boom and auxiliary hydraulic functions
- To prevent the carriage tilt function.

MAINTENANCE

Boom

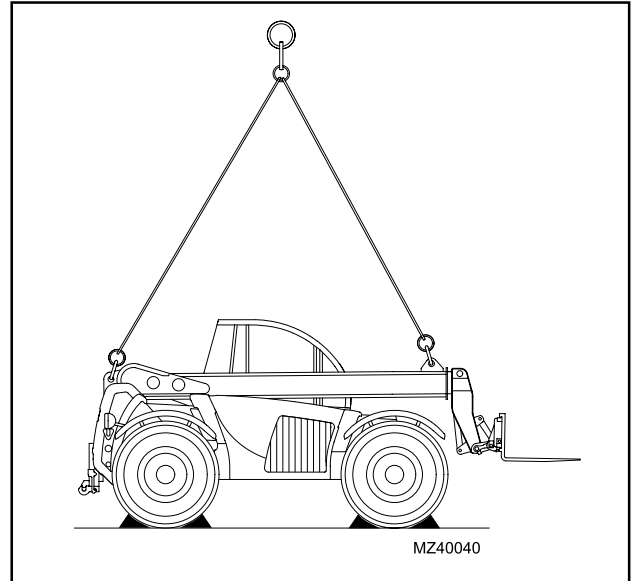
Removal

NOTE: This procedure details the removal of the boom as a complete assembly.

1. Park the machine on firm and level ground and chock the wheels. Make sure the boom is fully retracted and horizontal. Switch off the engine.

2. Refer to Page 1.53 and dump the hydraulic pressure.

WARNING *The boom is heavy. Use suitable lifting and support equipment. Take care when handling the boom, to avoid damage to components and injury to personnel.*



3. Remove the boom rear cover.

4. Connect suitable overhead lifting equipment, to the boom front and rear lifting eyes on the outer boom. Take the weight of the boom on the lifting equipment.

5. Identify the hydraulic hoses to make sure they are reconnected correctly. Disconnect the four hydraulic hoses (1) on the bulkhead connector bracket (2) to the crowd cylinder and auxiliary services. Blank the connectors and open hoses.

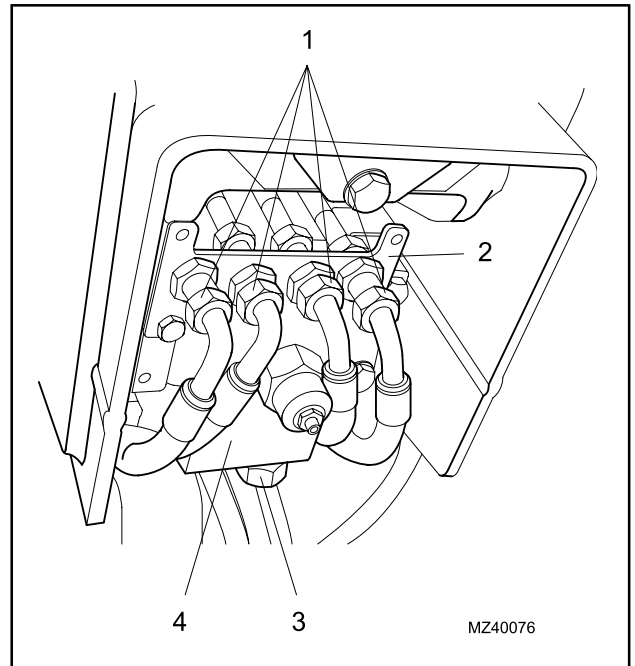
6. Identify the hydraulic hoses to make sure they are reconnected correctly. Disconnect the two hydraulic hoses (3) from the extension cylinder (4), blank the cylinder and open hoses.

NOTE: On early models, the attachment pins are slotted and retained by a locking plate.

7. Support the upper end of the lift cylinder (5). Remove the bolt (6), and washer (7) securing the upper attachment pin (8). Drive out the upper attachment pin and lower the cylinder onto a suitable support placed between the chassis and side members.

NOTE: On early models, the attachment pins are slotted and retained by a locking plate.

8. Support the upper end of the compensator cylinder (9).



1. Crowd/auxiliary hydraulic hoses
2. Bulkhead connector bracket
3. Lift hydraulic hoses
4. Lift cylinder

9. Remove the bolt (10) and washer (11) retaining the upper attachment pin (12).

10. Drive out the upper attachment pin, lower the cylinder onto the lift cylinder or a suitable support.

11. Disconnect the left and right rear light assembly lighting connectors adjacent to the main control valve. Remove the left and right rear lighting assemblies.

12. Remove the nut (13), washer (14), bolt (15) and washer (16) securing the boom pivot pin (17) to the trunnion on each side of the chassis. Remove the boom cover retaining clips (18).

NOTE: Shims are fitted between the left side of the boom and the chassis, make sure the shims are not trapped during removal of pin and boom.

13. Drive out the boom pivot pin (17). Once the pin clears the chassis, insert a 75 mm O/D tube through the chassis and into the boom. This tube will support and align the boom during pin removal. Continue to drive the pin out until clear of boom. Remove tube from chassis and boom.

WARNING *Make sure that the boom does not swing as it is lifted from the machine.*



14. Operate the overhead lifting equipment and remove boom from machine.

Installation

1. Installation is the reverse of the above procedure.

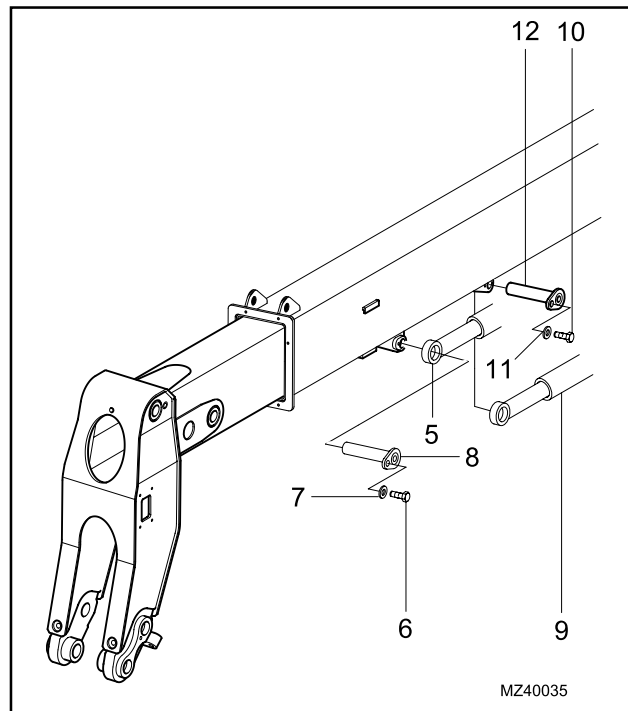
NOTE: Shims are fitted between the left side of the boom and the chassis. Make sure the shims take up the play between the chassis and boom. Various thickness shims are available.

2. When replacing the boom pivot pin (17), insert a 75 mm O/D tube through the chassis and into the boom to support the boom as the pin is being fitted. Make sure the shims are not damaged or trapped as the pin is fitted.

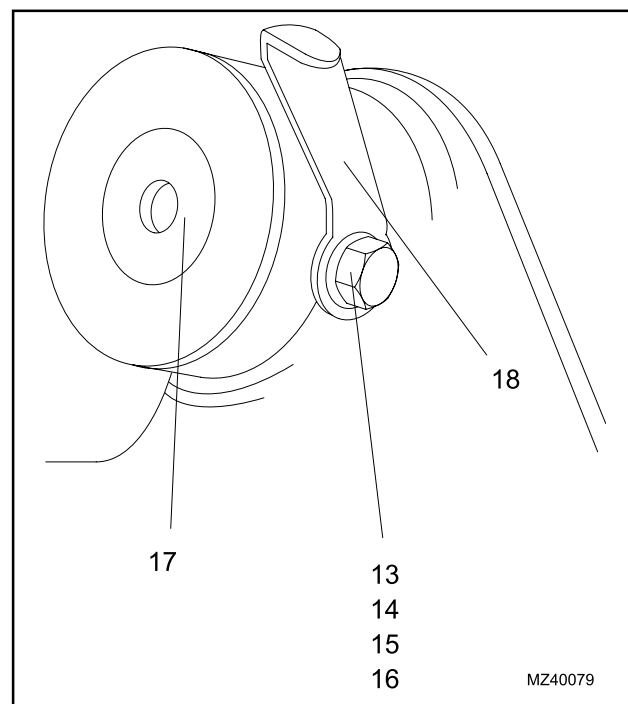
3. Refer to Page 1.54 and replenish the hydraulic tank before engine is started.

4. Purge the hydraulic system by starting the engine and operating the boom services to fully extend and retract cylinders several times.

5. Refer to Page 1.54. Check the hydraulic level and replenish if necessary.



5. Lift cylinder
6. Bolt
7. Washer
8. Attachment pin
9. Compensator cylinder
10. Bolt
11. Washer
12. Attachment pin



13. Nut
14. Washer
15. Bolt
16. Washer
17. Pivot pin
18. Retaining clip

HYDRAULIC CYLINDERS**Crowd cylinder**

For the removal, installation and maintenance of the crowd cylinder refer to the Hydraulic Manual.

Compensator cylinder

For the removal, installation and maintenance of the compensator cylinder refer to the Hydraulic Manual.

Lift cylinder

For the removal, installation and maintenance of the lift cylinder refer to the Hydraulic Manual.

Extension cylinder

For the removal, installation and maintenance of the extension cylinder refer to the Hydraulic Manual.

BOOM TRAY CASSETTE

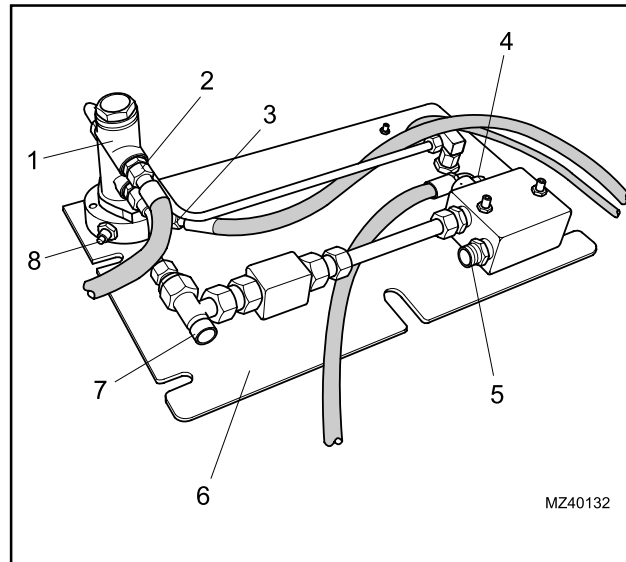
Removal

1. Park the machine on firm and level ground and chock the wheels. Make sure the boom is in the horizontal position and extended by 1.5 m (5 ft.). Switch off the engine.
2. Refer to Page 1.53 and dump the hydraulic pressure.1.
3. Remove the boom rear cover.
4. If a Trailer Brake Valve is fitted, identify the hydraulic hoses (2) and (3) to the valve (1). Disconnect the two hydraulic hoses (2 and 3) on the Trailer Brake Valve. Blank the connectors and open hoses.
5. Identify the hydraulic hoses to the rear hydraulic services (if fitted). Disconnect the two hydraulic hoses from the rear services. Blank the connectors and open hoses.
6. Identify the hydraulic hoses (4) and (5), if fitted, from the diverter valve to the manifold. Disconnect the two hydraulic hoses (4) and (5) from the manifold. Blank the connectors and open hoses.
7. Identify the return hydraulic hose (7) at the 'T' connector adjacent to the tap. Disconnect the return hydraulic hose (7) from the 'T' connector. Blank the connector and open hose.
8. Identify the hydraulic hoses (9) and (10) to the auto-hitch, if fitted. Disconnect the two hydraulic hoses (9) and (10) from the autohitch. Blank the connectors and open hoses.
9. Disconnect the electrical connector plugs to the trailer lighting socket and the reverse alarm.

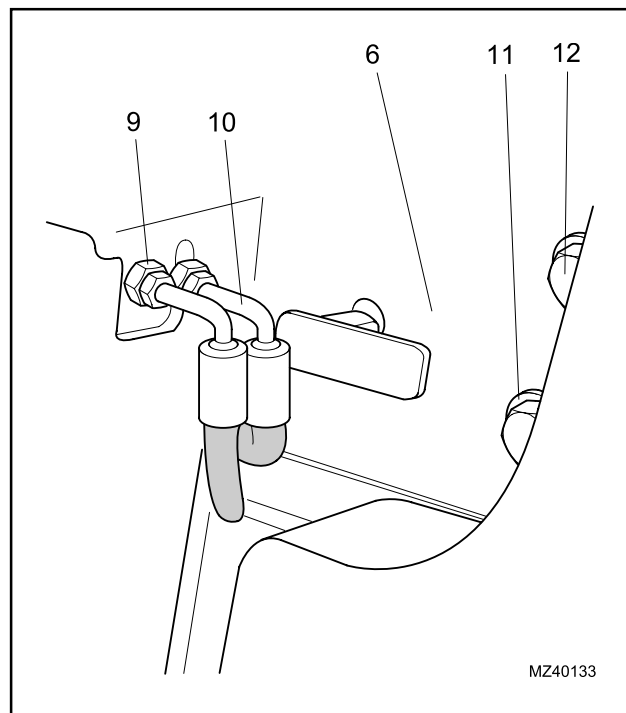
WARNING *The rear service plate weighs 15 kg (33 lb). Take care when handling, to avoid damage to components and injury to personnel.*



10. Support the rear service plate (6). Remove the four bolts (12), and washers (11) securing the rear service plate to the chassis and remove the rear service plate.



MZ40132



MZ40133

1. Trailer Brake Valve (if fitted)
2. Trailer brake hose (if fitted)
3. Trailer brake hose (if fitted)
4. Manifold to diverter valve hose (if fitted)
5. Manifold to diverter valve hose (if fitted)
6. Rear service plate
7. Return hose
8. Bleed Point (if fitted)
9. Auto-hitch hose (if fitted)
10. Auto-hitch hose (if fitted)
11. Washer
12. Bolt

11. Identify the hydraulic hoses (13). Disconnect the four hydraulic hoses (13) on the bulkhead connector bracket (15) to the crowd cylinder and auxiliary services. Blank the connectors and open hoses.

12. Identify the hydraulic hoses (20). Disconnect the two hydraulic hoses (20) from the extension cylinder (21), blank the cylinder and open hoses.

13. Remove the two bolts and washer (14) securing the bulkhead connector bracket to the outer boom (17). Pull the bracket and hoses rearwards by 0.5 m (1.6 ft.) to clear the boom.

14. Identify the hydraulic pipes (16). Disconnect the four hydraulic pipes (16) from the adapters on the bulkhead connector bracket (15) to the crowd cylinder and auxiliary services. Blank the connectors and open hoses.

WARNING *The extension cylinder weighs 140 kg (308 lb), take care when handling, to avoid damage to components and injury to personnel.*



15. Remove the circlip (23) securing the extension cylinder forward attachment pin (24) to the inner boom (22) and drive out the pin.

NOTE: Make a note of the position of the spigot mounting clamps located on each side of the rear cylinder attachment pin.

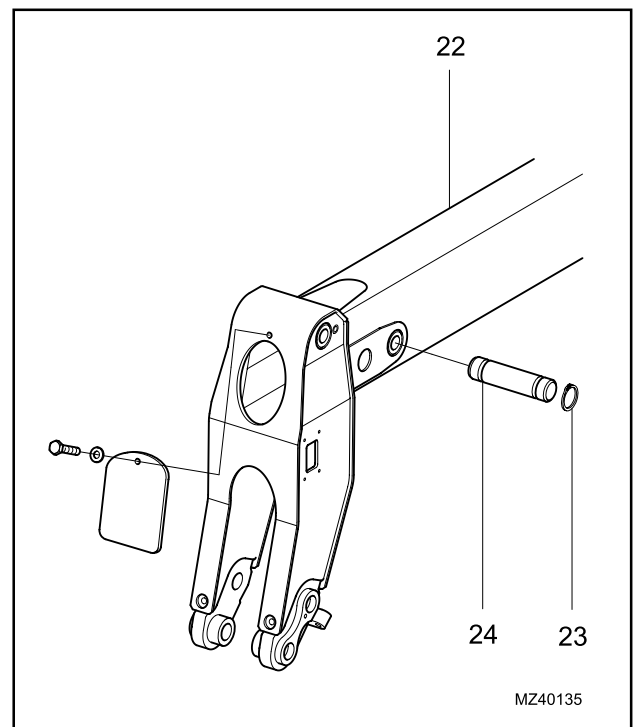
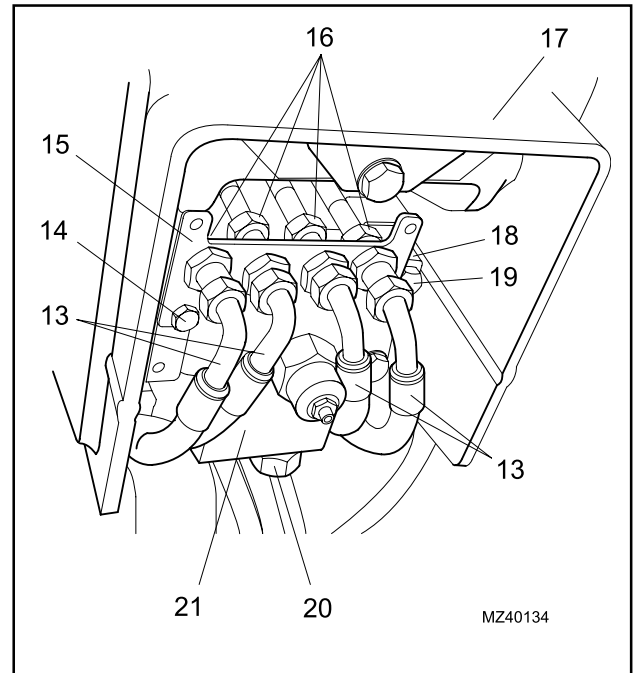
16. Remove the two bolts and washers (19), on each spigot mounting clamp (18), securing the rear attachment pin to the outer boom (17).

17. Remove the cylinder rearwards from the boom.

18. Disconnect hoses at the forward end of the boom from the auxiliary service/crowd cylinder.

19. Insert a bar, at least 2 m (7 ft.) long, from the forward end of the boom adjacent to the crowd cylinder into the end of the boom tray cassette to be removed. Use the bar to lever the cassette up and towards the centre of the boom.

20. From the rear of the boom, lift the cassette and slide out rearwards.



- 13. Crowd/auxiliary hoses
- 14. Bolt
- 15. Bulkhead connector bracket
- 16. Crowd/auxiliary pipes
- 17. Outer boom
- 18. Spigot mounting clamp
- 19. Bolt/washer
- 20. Extension cylinder hoses
- 21. Extension cylinder
- 22. Inner boom
- 23. Circlip
- 24. Forward attachment pin

Installation

1. Installation is the reverse of the above procedure.
2. Refer to Page 1.54 and replenish the hydraulic tank before engine is started.
3. Purge the hydraulic system by starting the engine and operating the boom services to fully extend and retract cylinders several times.
4. Refer to Page 1.54. Check the hydraulic level and replenish if necessary.

Dismantling

NOTE: The boom tray hoses can only be removed when the boom tray cassette has been removed.


1. Remove the two screws securing the hose support brackets to the rear of the boom tray.
2. Remove the clamp plate holding the hoses to the bracket.
3. Withdraw the steel tubes from the rear of the boom tray cassette.
4. Disconnect the hoses from the steel pipes on top of the boom tray.
5. Remove the sliding pipes and hoses from the rear of the cassette.

Assembly

1. Assemble the boom tray hoses in the reverse of the above procedure.
2. Install the boom tray in the boom.

INNER BOOM

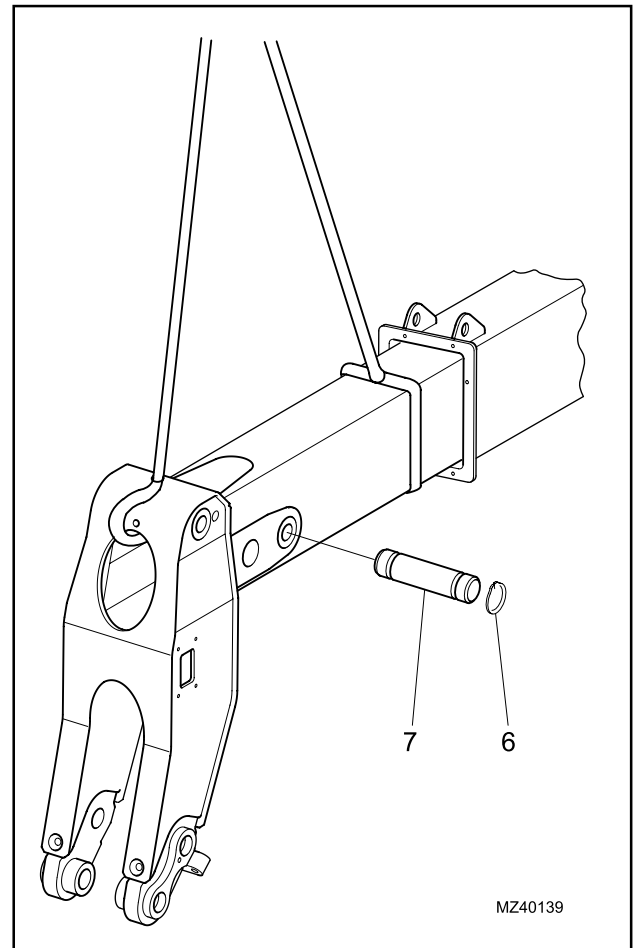
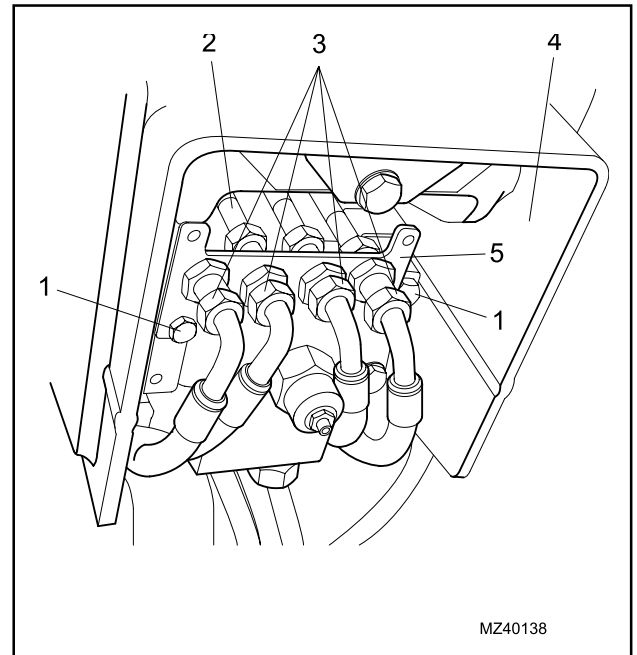
Removal

1. Park the machine on firm and level ground and chock the wheels. Make sure the boom is fully extended and horizontal. Switch off the engine.
 2. Refer to Page 1.53 and dump the hydraulic pressure.
 3. Support the inner boom.
 4. Remove the outer boom wear pads.
 5. Remove the boom rear cover.
 6. Identify the hydraulic hoses (3). Disconnect the four hydraulic hoses (3) on the bulkhead connector bracket (5) to the crowd cylinder and auxiliary services. Blank the connectors and open hoses.
 7. Remove the two bolts and washers (1) securing the bulkhead connector bracket to the outer boom (4). Pull the bracket and hoses rearwards by 0.5 m (1.6 ft.) to clear the boom.
 8. Identify the hydraulic hoses (2). Disconnect the four hydraulic pipes (2) from the adapters on the bulkhead connector bracket (5) to the crowd cylinder and auxiliary services. Blank the connectors and open hoses.
- WARNING** *The extension cylinder weighs 140 kg (308 lb), take care when handling, to avoid damage to components and injury to personnel.*
- 
9. Remove the circlip (6) securing the extension cylinder forward attachment pin (7) to the inner boom and drive out the pin.
 10. Lift the inner boom out of the outer boom using either a fork lift or overhead lifting equipment.

NOTE: An alternative method of removing the inner boom is to reverse the machine away from the inner boom.

Installation

1. Installation is the reverse of the above procedure.
2. Refer to Page 1.54 and replenish the hydraulic tank before engine is started.
3. Purge the hydraulic system by starting the engine and operating the boom services to fully extend and retract cylinders several times.
4. Refer to Page 1.54. Check the hydraulic level and replenish if necessary.



1. Bolt and washer
2. Hydraulic pipes
3. Hydraulic hose
4. Outer boom
5. Bracket
6. Circlip
7. Attachment pin

BOOM WEAR PADS

General

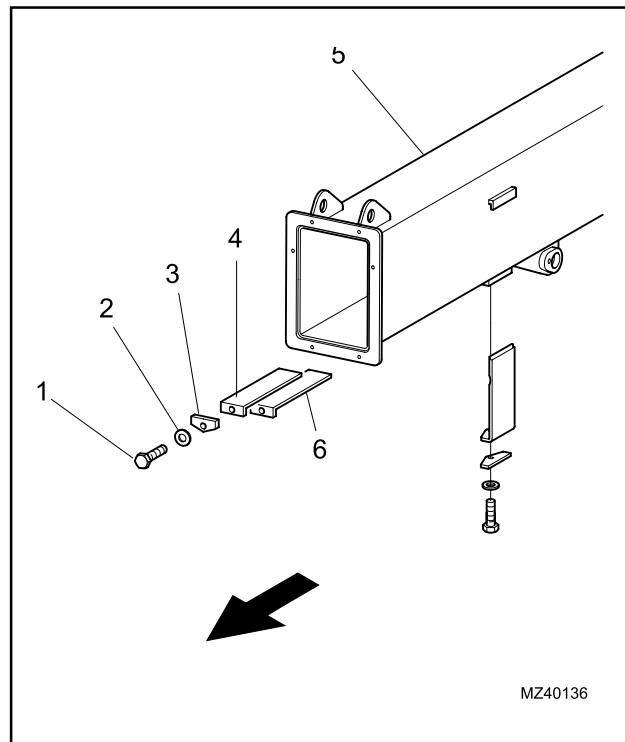
The front boom wear pads can be removed and installed with the boom assembled. The rear boom wear pads can only be removed and installed with the inner boom removed.

The wear pads are self-lubricating.

The pads should be fitted in pairs to the front lower positions of the outer boom and the rear upper section of the inner boom. At all other positions they may be fitted singly, as required.

Replacement of outer boom wear pads (front)

1. Park machine on firm level ground.
2. Extend the boom and roll the carriage face down onto the ground until the weight of the inner boom is supported and the weight is off the front lower wear pads.
3. Stop the engine, apply the parking brake and chock the wheels.
4. Refer to Page 1.53 and dump hydraulic pressure.
5. Remove the bolt (1), washer (2), retainer (3) and withdraw the wear pads and shims (4 & 6) at positions E and F from the bottom of the outer boom (5).
6. Clean and inspect the wear pads for wear and damage.
7. Fit wear pads E and F to the lower side of the boom with a 2.5 mm (0.10 in.) shim under each pad.
8. Start the engine and raise the boom until the weight rests on the bottom wear pads.
9. Stop the engine.
10. Refer to Page 1.53 and dump hydraulic pressure.
11. Remove bolt (1), washer (2), retainer (3) and withdraw the wear pad and shims (4 & 6) at positions A and D from the left and right side of the outer boom (5).
12. Clean and inspect the wear pads for wear and damage.



MZ40136

- | | |
|----|------------|
| 1. | Bolt |
| 2. | Washer |
| 3. | Retainer |
| 4. | Wear pad |
| 5. | Outer boom |
| 6. | Shim |

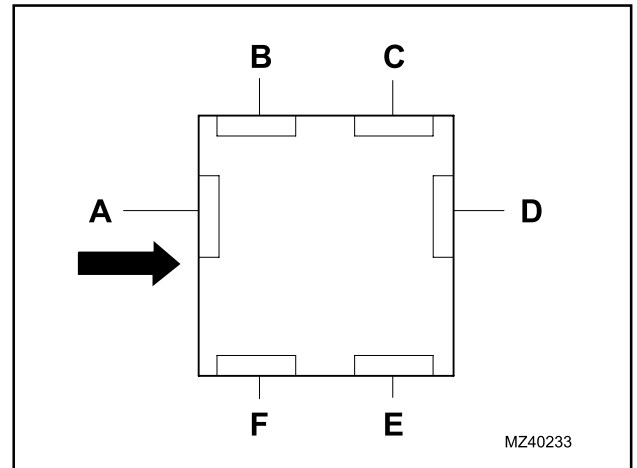
12. Fit wear pad D to the side of the boom with a 2.5 mm (0.10 in.) shim the pad.

13. Lever the boom against the inner boom in direction ➔. Fit wear pad A to the side of the boom and shim to give a clearance of less than 1.0 mm (0.040 in.)

14. Remove bolt (1), washer (2), retainer (3) and withdraw the wear pad and shims (4 & 6) at positions B and C from the upper side of the outer boom (5).

15. Clean and inspect the wear pads for wear and damage.

16. Fit wear pad B and C to the upper side of the boom and shim to give a clearance of less than 1.0 mm (0.040 in.).



Replacement of outer boom wear pads (side)

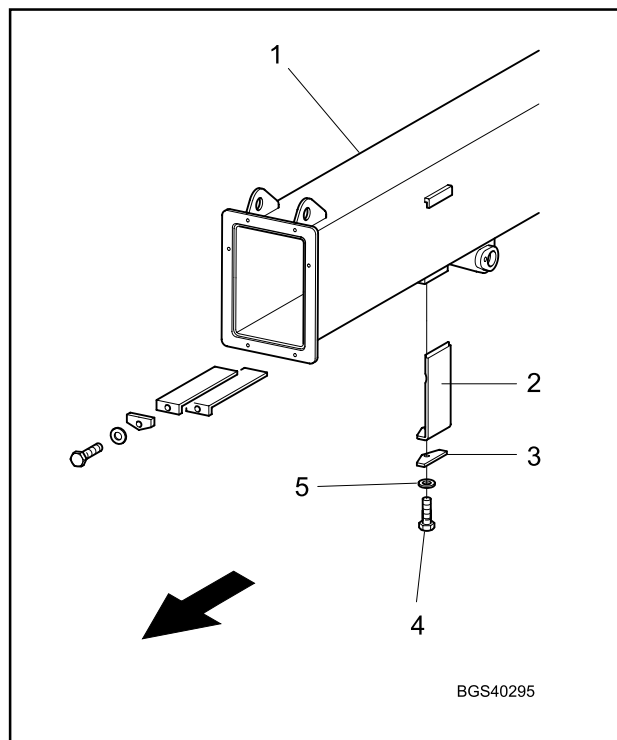
NOTE: Side boom wear pads are only fitted to models from Serial No. 51200020 to 51200480.

1. Park machine on firm level ground.
2. Extend the boom and roll the carriage face down onto the ground until the weight of the inner boom is supported.
3. Stop the engine, apply the parking brake and chock the wheels.
4. Refer to Page 1.53 and dump hydraulic pressure.
5. Remove the bolt (4), washer (5), retainer (3) and withdraw the wear pad (2) from both side positions on the outer boom (1).

Clean and inspect the wear pads for wear and damage.

Refit wear pads in reverse order of removal but renew wear pads excessively worn or damaged.

NOTE: Shims are not fitted to the side position wear pads.



1. Outer boom
2. Wear pad
3. Retainer
4. Bolt
5. Washer

Replacement of inner boom wear pads (rear)

Remove the inner boom.

Remove the bolt (4), washer (5), retainer (6) and remove the wear pads (2) and shims (3) from all positions of the inner boom (1).

Clean and inspect the wear pads for wear and damage.

Fit wear pad A to the lower boom with a 2.5 mm (0.10 in.) shim under the pad.

NOTE: Only one wear pad is fitted at the bottom of the inner boom.

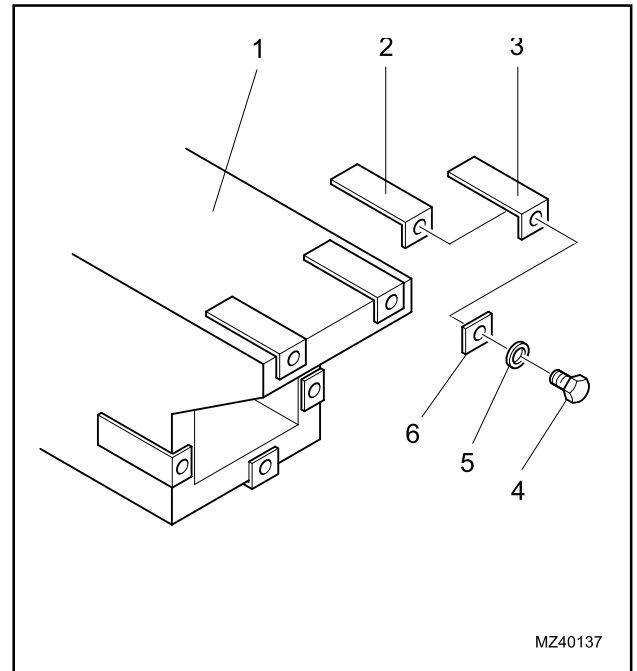
Fit wear pad B to the left side of the boom with a 2.5 mm (0.10 in.) shim under the pad.

Fit wear pads C, D and E to the boom without any shims under the pads.

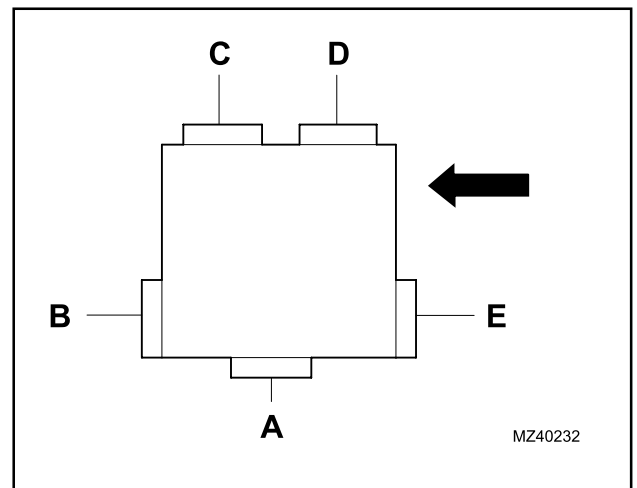
Refit the inner boom.

Lever the boom against the outer boom in direction ←. Measure the clearance between the wear pad E and the outer boom and shim to give a clearance of less than 1.0 mm (0.040 in.).

Measure the clearance between the wear pads C and D and the outer boom and shim to give a clearance of less than 1.0 mm (0.040 in.).



1. Inner boom
2. Shim
3. Wear pad
4. Bolt
5. Washer
6. Retainer



SECTION 5

CHASSIS

CHASSIS

Description

The chassis is constructed using a central U-section with an open upper section to allow the boom to sit lower in the frame.

Attached to the chassis are the engine pod on the right side and the cab pod on the left side.

The engine pod can be removed as a unit from the chassis to provide quick and easy engine/transmission removal. For engine removal, refer to the Engine section.

The cab pod is attached to the left side of the chassis and houses the fuel tank. The operators cab is secured to the cab pod.

The operators cab is easily removed for access to the fuel tank.

The front and rear axles are attached to mounting points on the chassis.

The boom is pivoted at the rear of the chassis on wide mounting points for good stability. The chassis is reinforced at the boom pivot point with gussets for extra strength.

Operators cab

Removal

1. Park the machine on firm level ground, apply the parking brake and chock the wheels.
2. Raise the boom and fit the boom safety prop.
3. Stop the engine.
4. Refer to Page 1.53 and dump hydraulic pressure, then disconnect the battery.
5. Remove the front cover from the cab pod below the front windscreen.

NOTE: Apply identification marks to all electrical cables and hydraulic hoses as an aid to assembly.

6. Disconnect the hoses to the brake valve and tie clear of the cab.
7. Disconnect the front and rear windscreen washer pipe at the washer bottle.
8. Disconnect the four electrical connector plugs from the cab front bulkhead.
9. Disconnect hoses from the steering valve and tie back clear of the cab, fit blanks to open pipes and steering valve connections.
10. Remove the left headlight and sidelight from the cab. Remove the left side worklight (if fitted).

CAUTION *Do not drain the coolant until the engine is cold.*



11. Clamp the heater hoses at the rear of the cab to prevent leakage then drain the engine coolant system.
12. Remove the external heater pipes from the plate on the rear of the cab.
13. If air conditioning is fitted, recover the gas from the system and disconnect the two pipes from the plate on the rear of the cab.

14. Support the cab using suitable lifting equipment attached to the lifting eyes installed on the cab roof guard.

NOTE: The thread size of the lifting eyes is M16.

15. Remove the front and rear bolts attaching the cab to the pod.

16. Lift the cab from the machine using suitable lifting equipment and position on a stand.

Installation

1. Before installation of the cab inspect the rubber mounts on the pod and make sure they are serviceable, replace if necessary.

2. Before installation of the cab inspect the fuel tank in the pod for security, make sure it is not damaged or leaking and the sender unit cable is connected.

3. Make sure the fuel supply and return hoses are routed correctly, to avoid trapping and chaffing.

4. Installation is the reverse of the above procedure, note the following points:

5. Torque load the cab attachment bolts to 250 Nm (184 lbf ft.).

6. Refit cooling system hoses and top up system as required.

7. Refer to Page 1.55 and check the hydraulic level and replenish as required.

8. Refer to Page 1.52 and bleed the brakes.

9. Charge the air conditioning system (if fitted).

10. Check the following machine functions and indications:


- Start engine, make sure oil pressure warning light goes out and the tacho and hour meter operates. Make sure battery charge indicator light goes out
- Make sure fuel and temperature gauges indicate.
- Select all forward and reverse gears and check indication
- Operate all boom functions

- Operate brake dump selector switch, make sure transmission selects neutral
- Operate all lights, including rear foglight
- Operate horn
- Operate the direction indicators and hazard warning lights
- Operate parking brake. Make sure warning light is on
- Operate foot brakes
- Operate steering in all modes to bleed air from the system and check indicator lights
- Operate front and rear wipers and washers
- Operate the rear, side and boom worklights (if fitted)
- Test overload indicator
- Test heater/air conditioning
- Operate rotating beacon
- Check hydraulic and cooling system fluid levels and fill to correct level as necessary
- Road test machine.

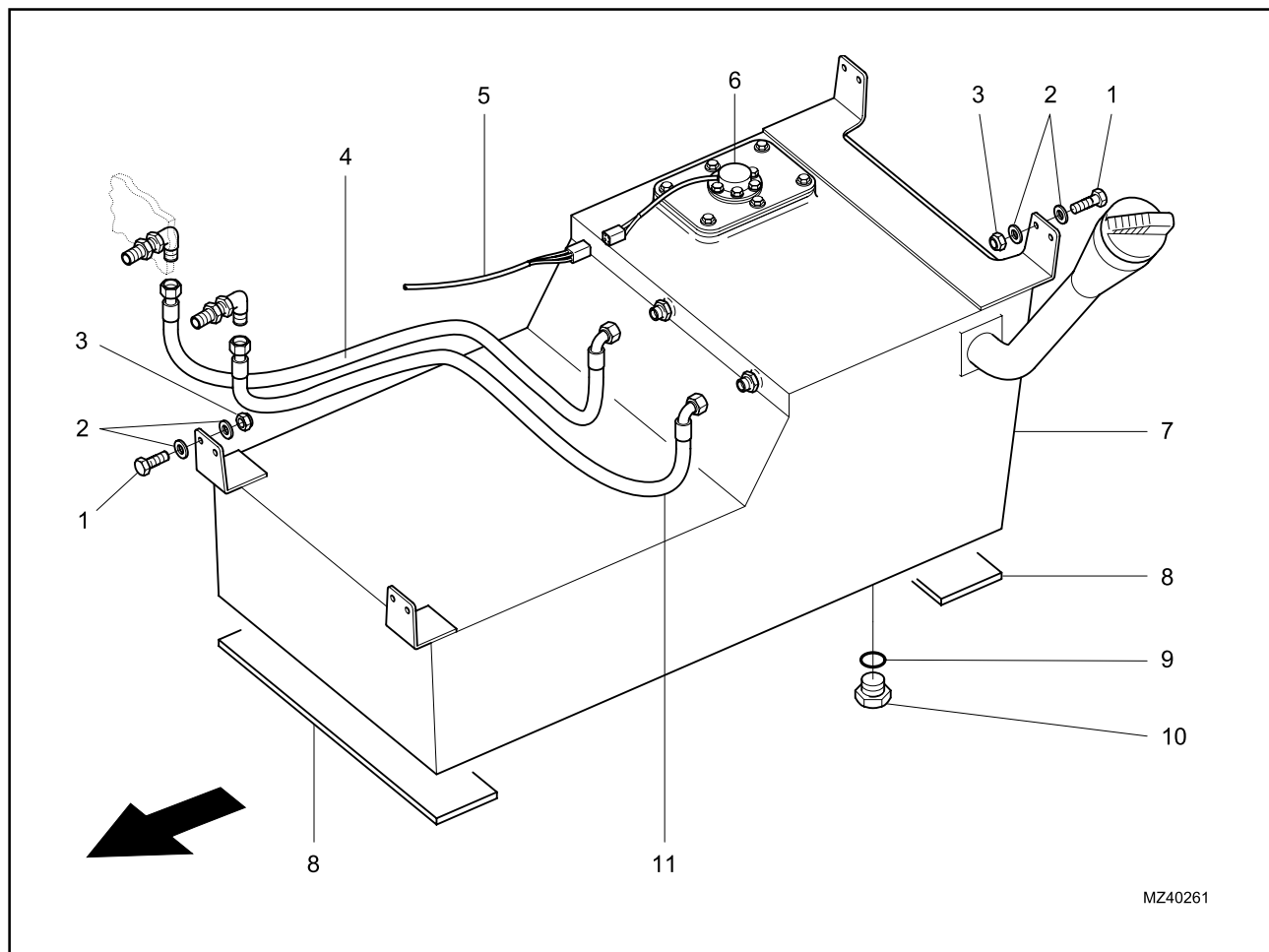
Fuel tank

Removal

1. Park the machine on firm level ground.
2. Stop the engine, chock the wheels and disconnect the battery.

WARNING  *The fuel tank capacity is 200 litres, make sure the drain tank has sufficient capacity to hold the contents of the fuel tank.*

3. Drain the contents of the fuel tank (7) into a suitable container through the drain plug (10).
4. Refer to the Operators Cab removal procedure and remove the cab from the pod.
5. Disconnect the cable (5) from the fuel sender unit (6).
6. Remove the two fuel hoses (4) and (11) between the tank and the front bulkhead of the pod. Fit suitable blanks to the hoses and connectors.
7. Remove the bolts, washers and nuts (1), (2) and (3) securing the fuel tank to the front and rear bulkheads of the pod.
8. Remove the tank (7) from the pod.



MZ40261

- | | | | |
|----|-------------|-----|----------------|
| 1. | Bolt | 7. | Fuel tank |
| 2. | Washer | 8. | Support strip |
| 3. | Nut | 9. | Sealing washer |
| 4. | Hose | 10. | Drain plug |
| 5. | Cable | 11. | Hose |
| 6. | Sender unit | | |

Installation

1. Inspect the pod for damage, make sure the tank support strips (11) are in good condition, replace if necessary.
2. Inspect the interior of the tank, make sure clean and clear of debris.
3. Fit drain plug (2) to fuel tank with a new sealing washer (3).
4. Installation is the reverse of the above procedure.
5. Refuel the fuel tank and check for leaks.
6. After tank installation, refer to the cab installation procedure and install the cab.

Heater and air conditioning

Description

The heater assembly is fitted in a compartment behind the cab seat and includes the heater coil and blower motor.

When the air conditioning option is fitted, the heater compartment also contains the evaporator coil, receiver, trinary switch and expansion valve. The condenser coil and axial fans are fitted in a housing outside the cab, above the rear screen. The compressor is fitted in the engine compartment and driven by a V-belt from the engine crankshaft.

Blower motor

Removal

1. Park the machine on firm level ground.
2. Stop the engine, chock the wheels and disconnect the battery.

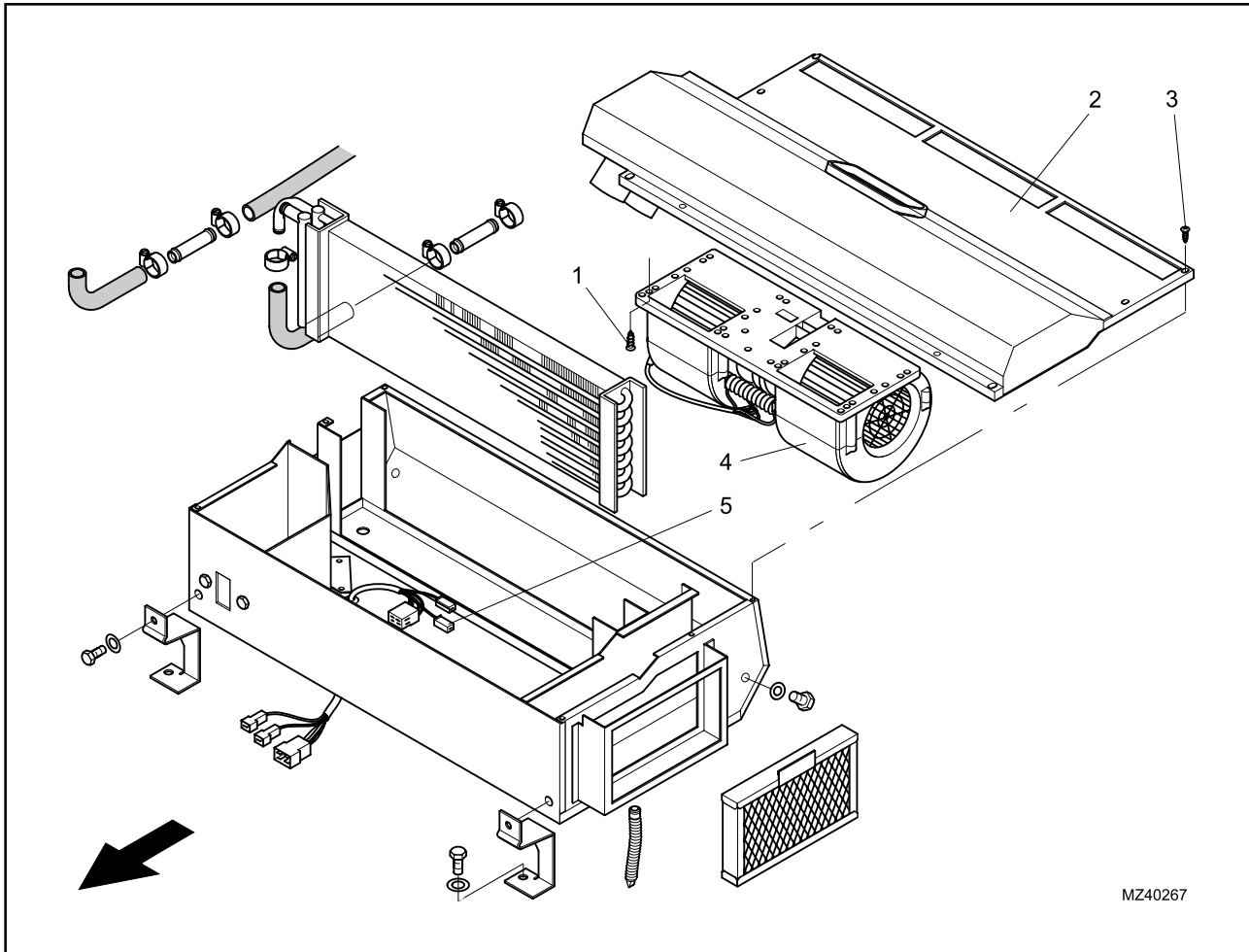
WARNING *The seat weighs 50 kg (approx). Take care when lifting the seat, to avoid injury to personnel and damage to equipment.*



3. Remove the seat as follows:
 - Remove plastic rivets from skirt
 - Disconnect joystick wiring harness
 - Remove four bolts securing seat to cab base
 - Remove the seat from the cab.
4. Remove the rear cab trim panel.
5. Remove the self-tapping screws (3) securing the housing lid (2), lift the housing lid to get access to the blower motor electrical connections.
6. Disconnect the blower motor electrical connections (5) and remove housing lid complete with blower motor (4).
7. Remove the self-tapping screws (1) securing blower motor (4) to the housing lid (2) and remove blower motor.

Installation

1. Installation is the reverse of the above procedure.
2. Test the blower motor before fitting the seat.
3. After fitting the seat, test the joystick controls.



1. Self-tapping screw
2. Housing lid
3. Self-tapping screw
4. Blower motor
5. Electrical connectors

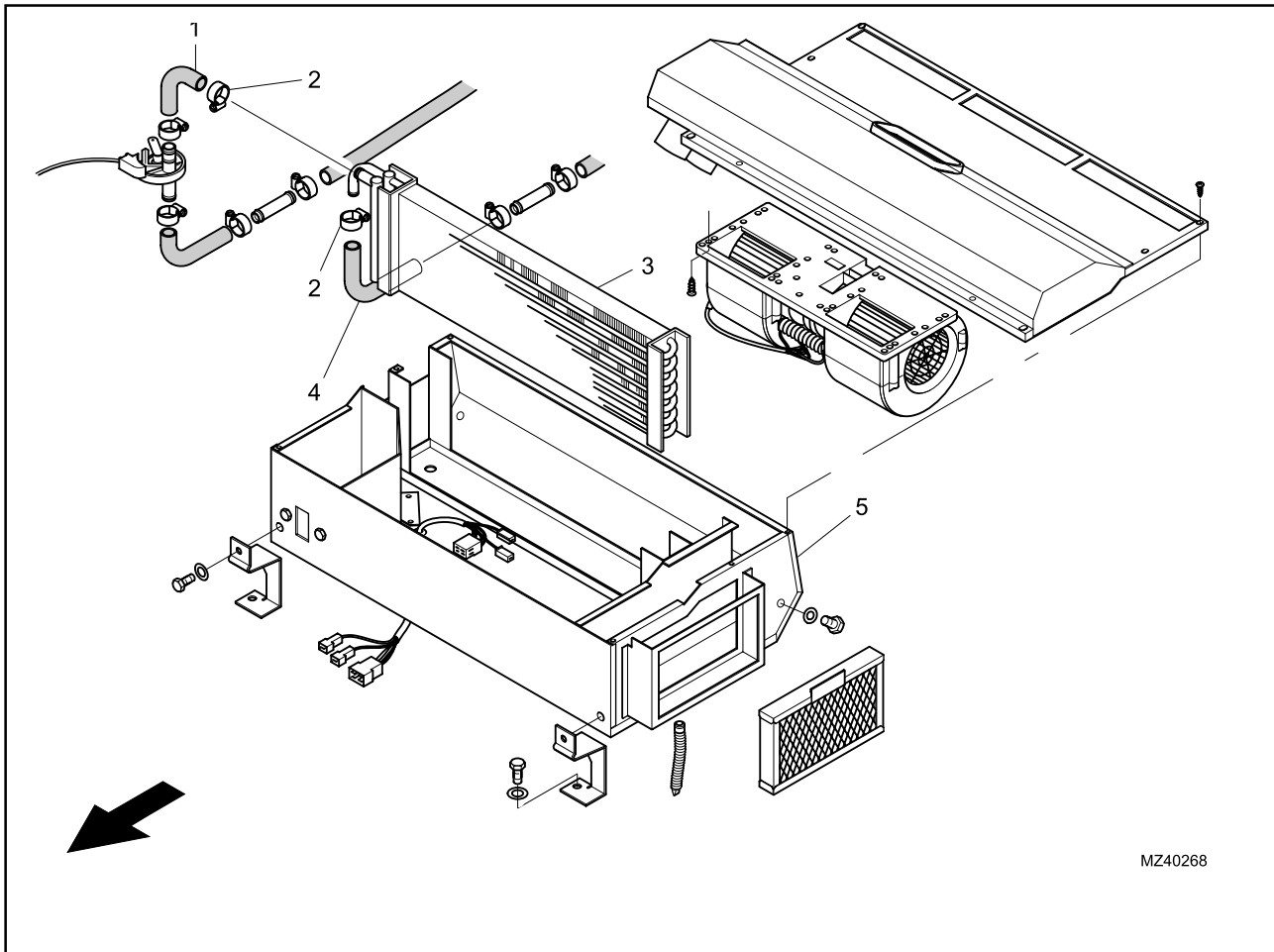
Heater coil

Removal

1. Park the machine on firm level ground.
2. Stop the engine, chock the wheels and disconnect the battery.
3. Refer to the blower motor removal procedure and get access to the heater housing.
4. Clamp the two hoses (1) and (4) to the heater coil (3), remove the hose clips (2) from the hoses and disconnect the two hoses from the heater coil.
5. Slide the heater coil out of the housing (5).

Installation

1. Installation is the reverse of the above procedure.
2. Remove the clamps from the heater hoses (1) and (4).
3. Start the engine, check the hoses (1) and (4) for leaks.
4. Stop the engine and check the coolant level, fill to correct level as necessary.
5. Test the blower motor before fitting the seat.
6. After fitting the seat, test the joystick controls.



1. Hose
2. Hose clip
3. Heater coil
4. Hose
5. Housing

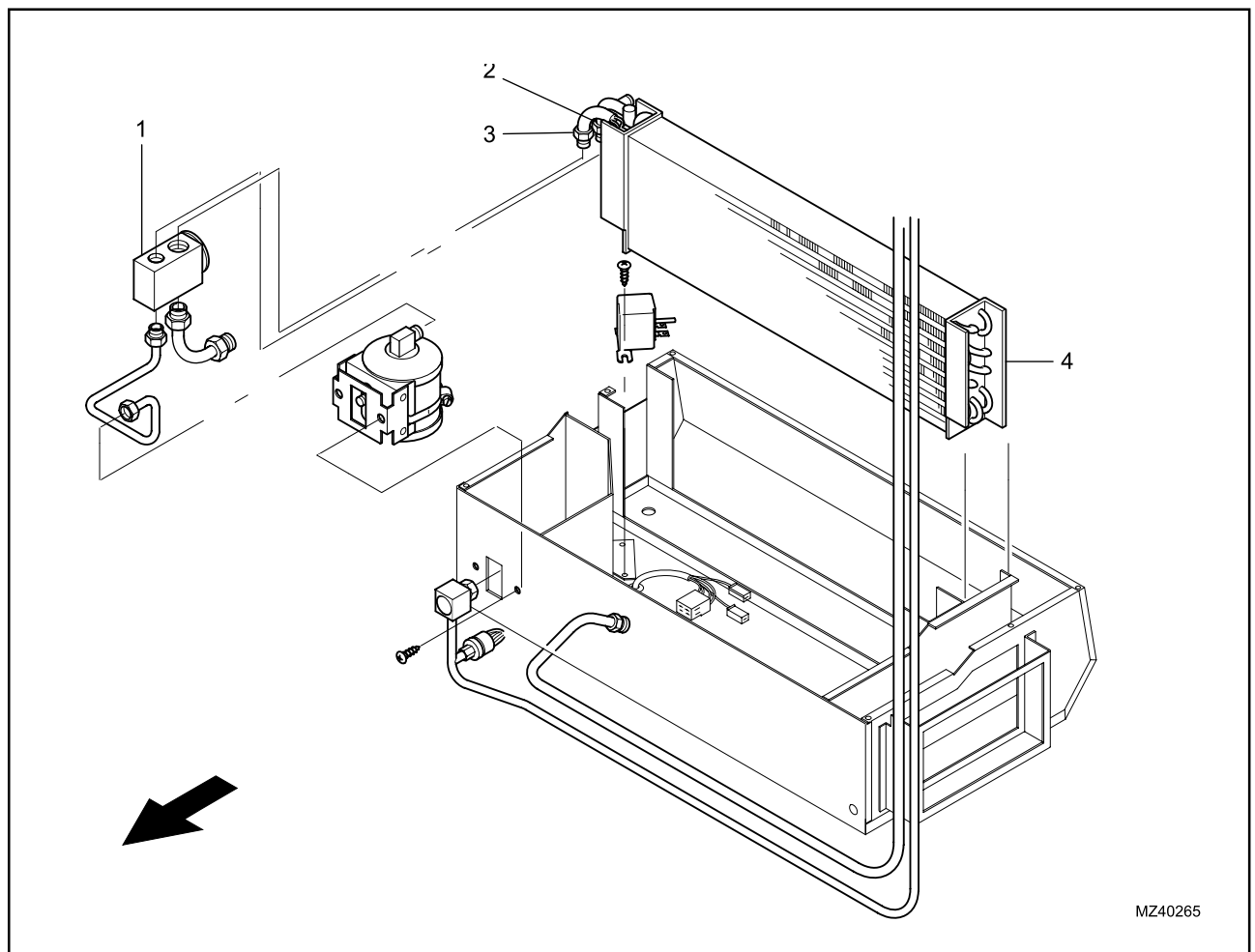
Air conditioning evaporator coil

Removal

1. Park the machine on firm level ground.
2. Stop the engine, chock the wheels and disconnect the battery.
3. Refer to the blower motor removal procedure and get access to the heater housing.
4. Recover the gas from the system using suitable equipment.
5. Disconnect the two adapters (2) and (3) connecting the evaporator coil (4) to the expansion valve (1).
6. Slide the evaporator coil out of the housing.

Installation

1. Installation is the reverse of the above procedure.
2. Test the blower motor before fitting the seat.
3. After fitting the seat, test the joystick controls.
4. Charge the system using suitable refrigerant charging equipment.
5. Test the air conditioning system.



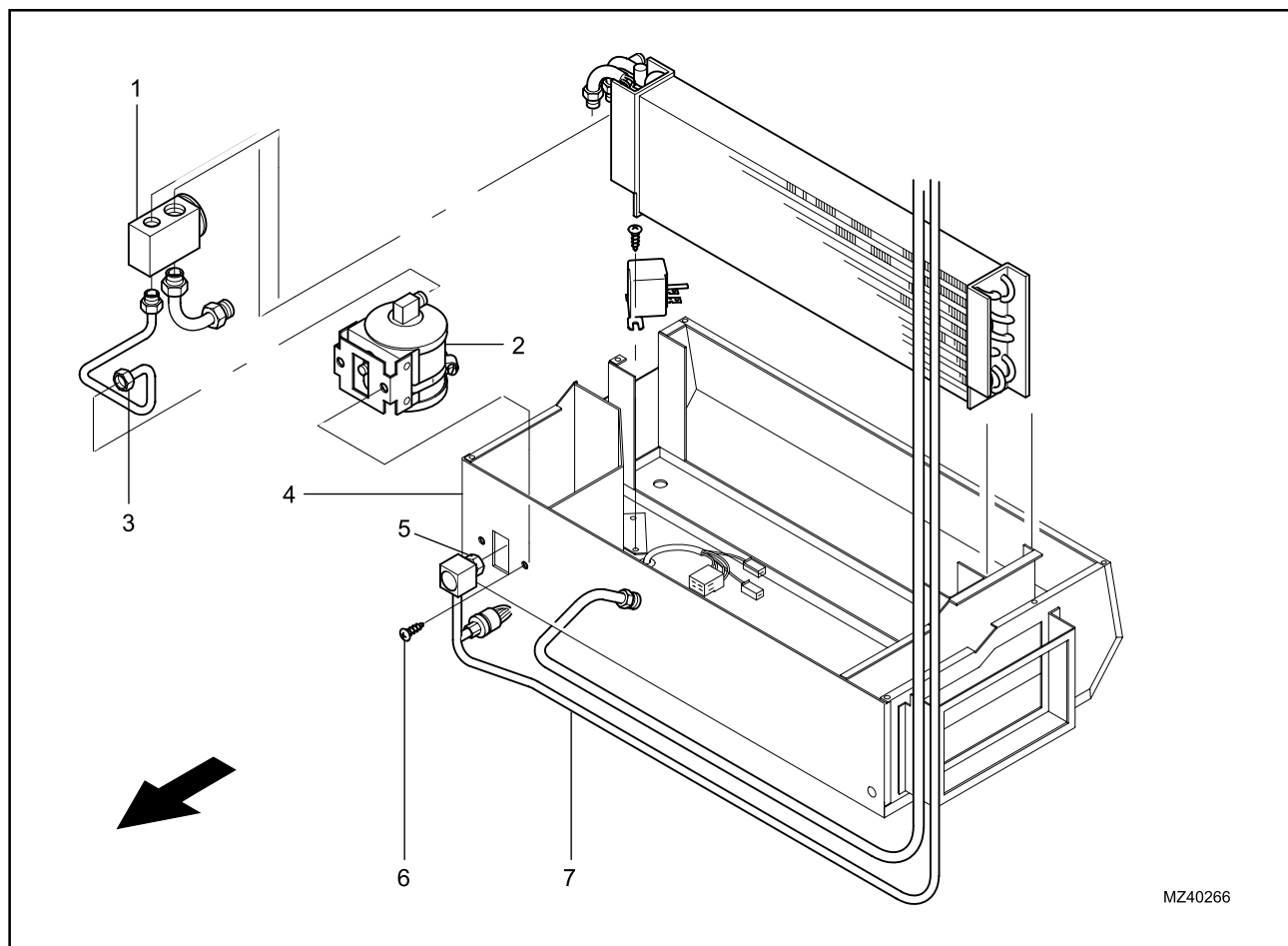
MZ40265

1. Expansion valve
2. Adapter
3. Adapter
4. Evaporator coil

Receiver-Drier Assembly

Removal

1. Park the machine on firm level ground.
2. Stop the engine, chock the wheels and disconnect the battery.
3. Refer to the blower motor removal procedure and get access to the heater housing.
4. Recover the gas from the system using suitable equipment.
5. Disconnect the adapter (4) connecting the receiver-drier (2) to the expansion valve (1).
6. Disconnect the adapter (5) connecting the receiver-drier (2) to the external pipe (7).
7. Remove the two self-tapping screws (6) securing the receiver-drier (2) to the housing (3) and remove the receiver-drier.



- | | | | |
|----|-----------------|----|---------------------|
| 1. | Expansion valve | 5. | Adapter |
| 2. | Receiver-drier | 6. | Self-tapping screws |
| 3. | Housing | 7. | Pipe |
| 4. | Adapter | | |

Installation

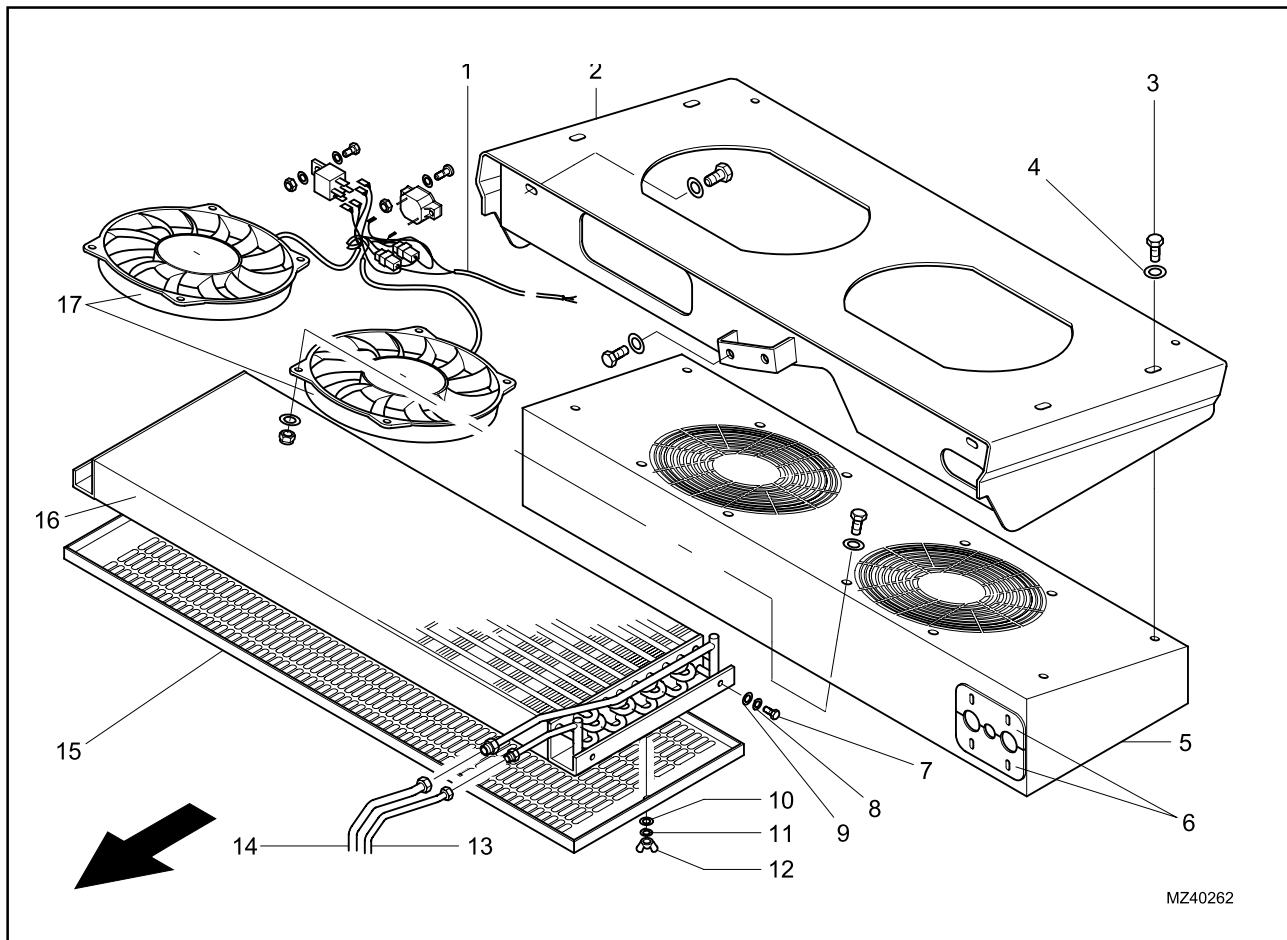
1. Installation is the reverse of the above procedure.
2. Test the blower motor before fitting the seat.
3. After fitting the seat, test the joystick controls.
4. Charge the system using suitable refrigerant charging equipment.
5. Test the air conditioning system.

Air conditioning condenser coil**Removal**

1. Park the machine on firm level ground.
2. Stop the engine, chock the wheels and disconnect the battery.
3. Remove the two wingnuts and washers (12), (11) and (10) securing the grille (15) below the condenser coil (16). Remove the grille.
4. Recover the gas from the system using suitable equipment.
5. Disconnect the two pipes (14) and (13) to the condenser coil. Remove the pipe support blocks (6) from the coil housing (5).
6. Remove the cab roof lining and disconnect the multiplug from the condenser. Identify the wiring connectors then disconnect the wiring loom (1) to the axial fans (17).
7. Support the unit then remove the four bolts and washers (3) and (4) securing the condenser coil housing (5) to the machine support (2) and remove the unit. Pulling the cable through from the cab.
8. Remove the four bolts and washers (7), (8) and (9) securing the condenser coil to the housing and remove coil.

Installation

1. Installation is the reverse of the above procedure.
2. Charge the system using suitable refrigerant charging equipment.
3. Test the air conditioning system.



1. Wiring loom
2. Machine support
3. Bolt
4. Washer
5. Condenser coil housing
6. Support block
7. Bolt
8. Washer
9. Washer
10. Washer
11. Washer
12. Wingnut
13. Pipe
14. Pipe
15. Grille
16. Condenser coil
17. Axial fan

Axial fan and relay

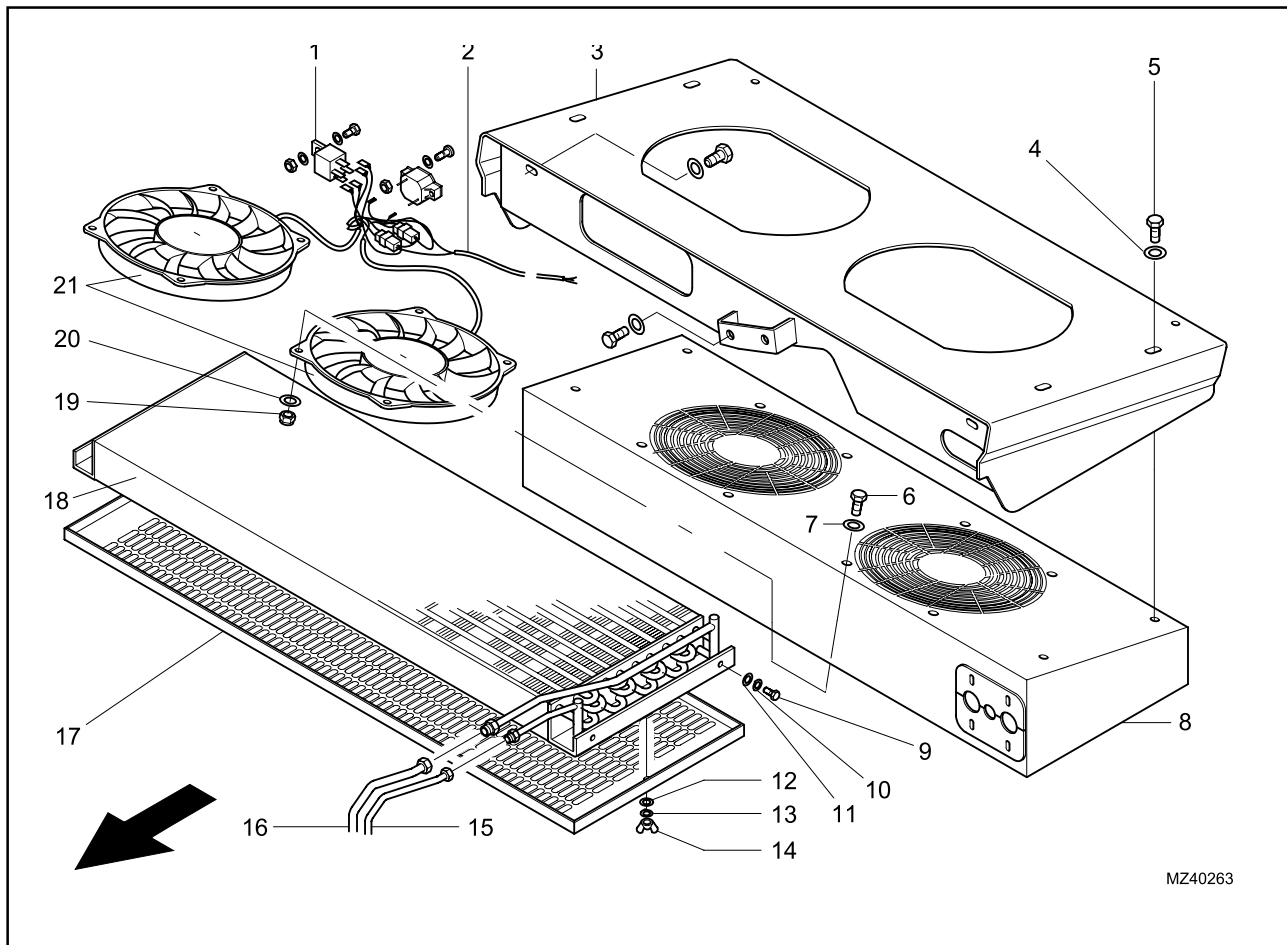
Removal

NOTE: Two axial fans (21) are fitted, the removal procedure is the same for both fans.

1. Park the machine on firm level ground.
2. Stop the engine, chock the wheels and disconnect the battery.
3. Remove the two wingnuts and washers (14), (13) and (12) securing the grille (17) below the condenser coil (18). Remove the grille (17).
4. Disconnect the two pipes (16) and (15) to the condenser coil. Remove the pipe support blocks from the coil housing (8).
5. Remove the cab roof lining and disconnect the multiplug from the condenser. Identify the wiring connectors then disconnect the wiring loom (2) to the axial fans (21).
6. Support the unit then remove the four bolts and washers (5) and (4) securing the condenser coil housing (8) to the machine support (3) and remove the unit.
7. Remove the four bolts and washers (9), (10) and (11) securing the condenser coil to the housing and remove coil.
8. Electrically disconnect the axial fan(s) from the wiring loom and relay (1). Remove the relay, if necessary, by removing the attachment bolt, washers and nut.
9. Remove the four bolts, washers and nuts (6), (7), (20) and (19) securing the axial fan(s) to the housing (8) and remove fan (21).

Installation

1. Installation is the reverse of the above procedure.
2. Charge the system using suitable refrigerant charging equipment.
3. Test the air conditioning system.



MZ40263

- | | | | |
|-----|------------------------|-----|----------------|
| 1. | Relay | 12. | Washer |
| 2. | Wiring loom | 13. | Washer |
| 3. | Machine support | 14. | Wingnut |
| 4. | Washer | 15. | Pipe |
| 5. | Bolt | 16. | Pipe |
| 6. | Bolt | 17. | Grille |
| 7. | Washer | 18. | Condenser coil |
| 8. | Condenser coil housing | 19. | Nut |
| 9. | Bolt | 20. | Washer |
| 10. | Washer | 21. | Axial fan |
| 11. | Washer | | |

Compressor

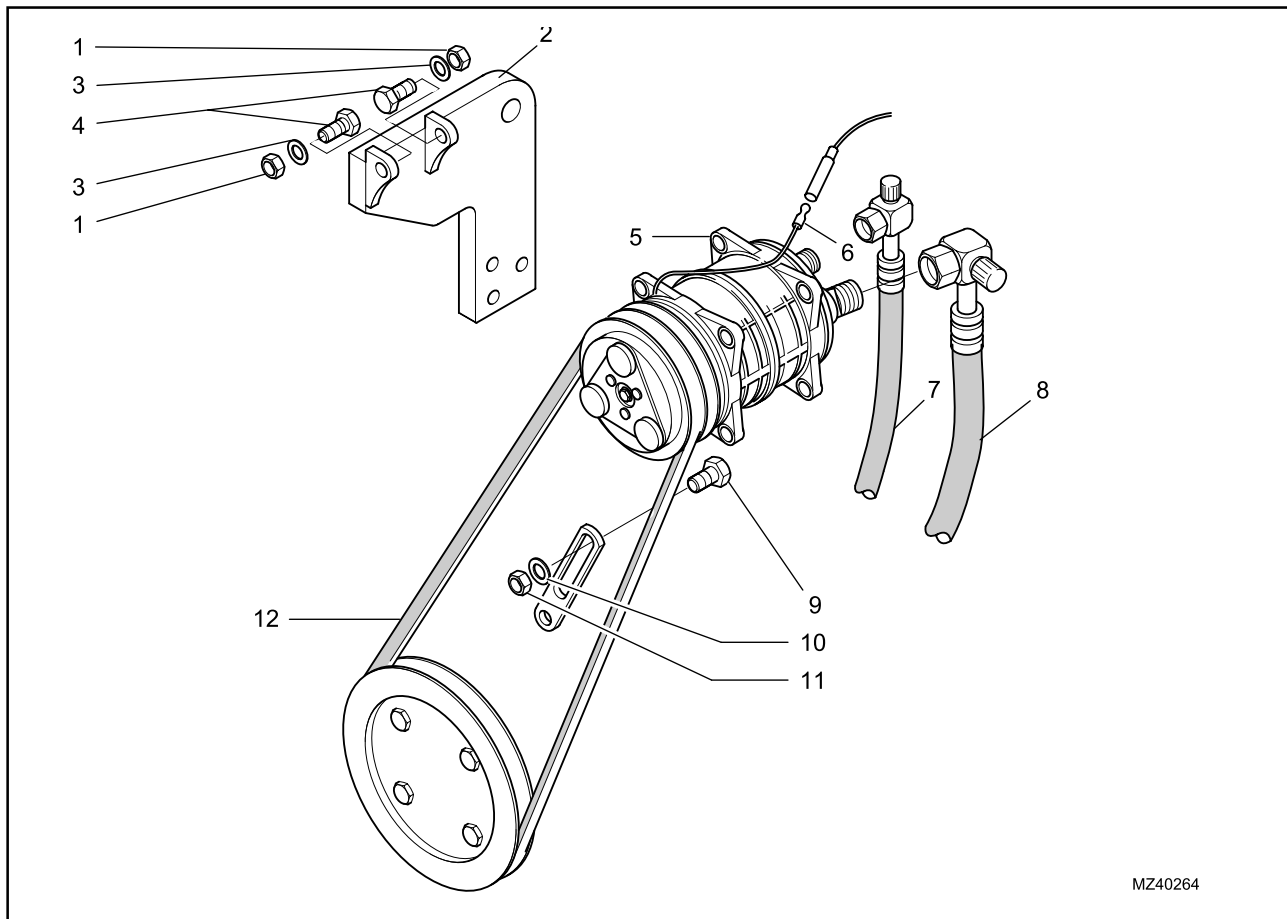
(Up to Machine S/No. 51200471 only)

Removal

1. Park the machine on firm level ground.
2. Stop the engine, chock the wheels and disconnect the battery.
3. Open the engine pod cover.
4. Recover the gas from the system using suitable equipment.
5. Disconnect the two Hoses (7) and (8) to the Compressor (5).
6. Disconnect the Electrical Lead (6) from the Compressor (5).
7. Loosen the Nuts (1) on the two attachment Bolts (4) for the Compressor (5).
8. Remove the adjuster Bolt (9), Washer (10) and Nut (11). Rotate the Compressor (5) and remove the pulley belt (11) from the pulley on the compressor (5).
9. Support the compressor (5) and remove the two bolts (4), Washers (3) and Nuts (1) securing the Compressor (5) to the support Bracket (2) and remove the Compressor (5).

Installation

1. Installation is the reverse of the above procedure.
2. Charge the system using suitable refrigerant charging equipment.
3. Secure the Compressor (5) in position to tension the pulley belt to 22 N. This will give a belt deflection of no more than 16 mm at the mid-point of the longest span.
4. Test the air conditioning system.



MZ40264

1. Nut
2. Support Bracket
3. Washer
4. Bolt
5. Compressor
6. Electrical lead
7. Hose
8. Hose
9. Bolt
10. Washer
11. Nut
12. Pulley Belt

Compressor

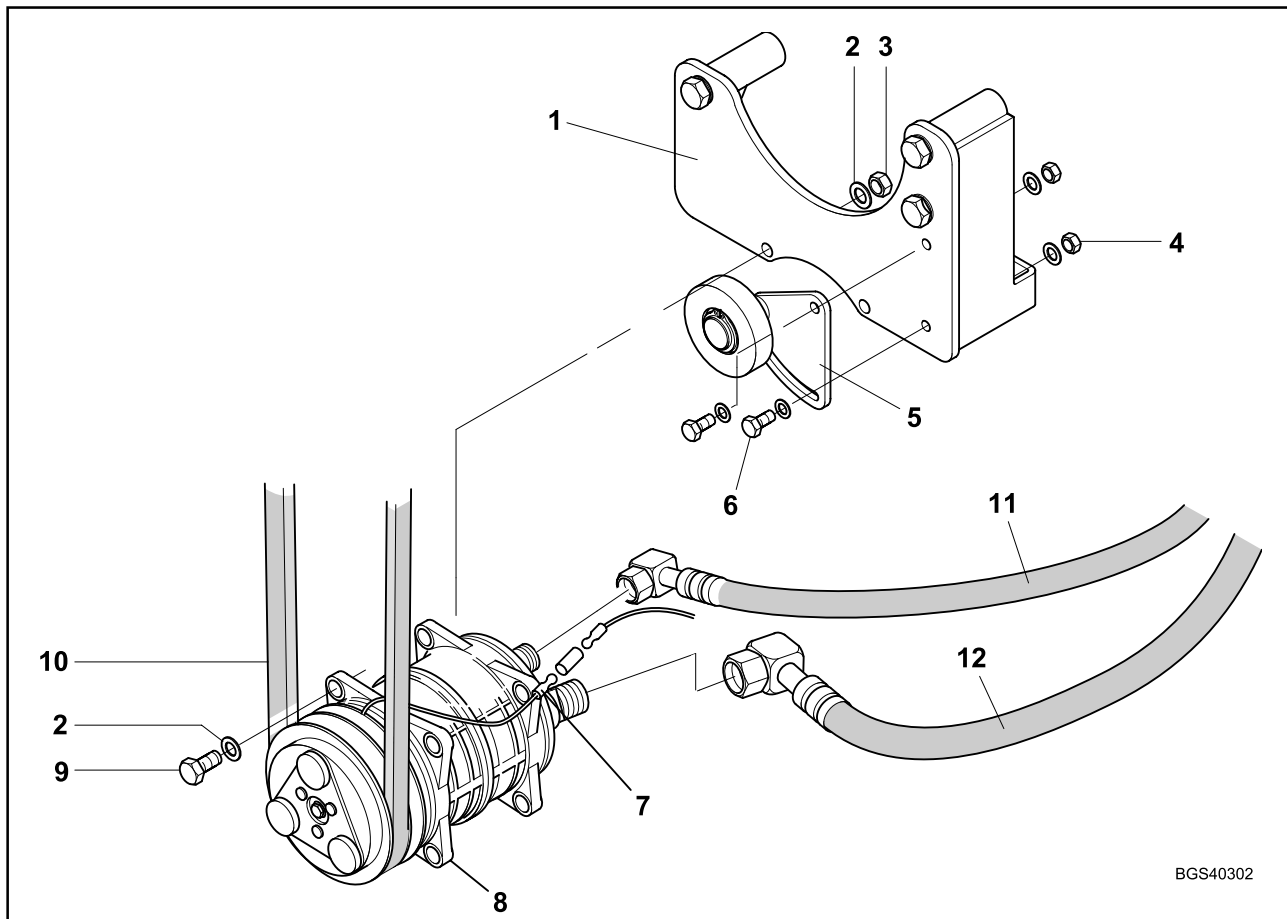
(From Machine S/No. 51200472 only)

Removal

1. Park the machine on firm level ground.
2. Stop the engine, chock the wheels and disconnect the battery.
3. Open the engine pod cover.
4. Recover the gas from the system using suitable equipment.
5. Disconnect the two Hoses (11) and (12) to the compressor (8).
6. Disconnect the Electrical Lead (7) from the Compressor (8).
7. Loosen the Nuts (4) on the two attachment Bolts (6) for the pulley belt Tensioner (5).
8. Move the Tensioner (5) to release the tension on the pulley Belt (10) and remove pulley Belt (10) from the pulley on the Compressor (8).
9. Support the Compressor (8) and remove the three Bolts (9), six Washers (2) and three Nuts (3) securing the Compressor (8) to the support Bracket (1) and remove the Compressor (8).

Installation

1. Installation is the reverse of the above procedure.
2. Charge the system using suitable refrigerant charging equipment.
3. Secure the Tensioner (5) in position to tension the pulley belt to 22 N. This will give the pulley Belt (10) a deflection of no more than 16 mm at the mid-point of the longest span.
4. Test the air conditioning system.



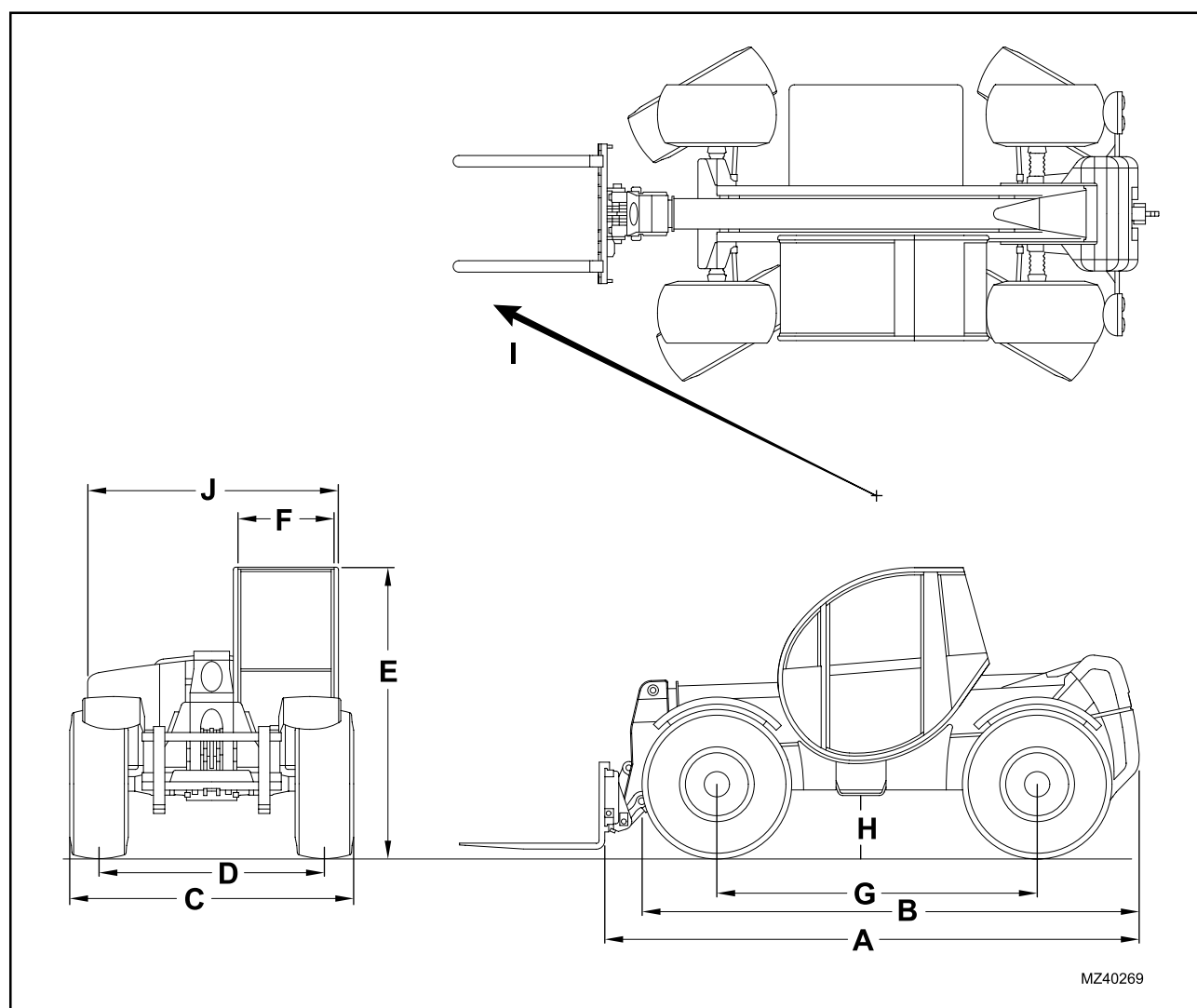
BGS40302

1. Support Bracket
2. Washer A10
3. Nut M10
4. Nut
5. Pulley Tensioner
6. Bolt
7. Electrical Connector
8. Compressor
9. Bolt M10 x 35
10. Pulley Belt
11. Hose
12. Hose

SECTION 6

TECHNICAL DATA

		K50	K60	K70
Dimensions				
A Length to front of carriage	mm	4705	4705	4705
B Length front to rear wheels	mm	3876 (20 in. tyres)	4079	4079
C Overall width	mm	2300	2300	2300
D Track width	mm	1920	1920	1920
E Height over cab on std tyres	mm	2380 (20 in. tyres)	2450	2450
F Interior cab width	mm	900	900	900
G Wheelbase	mm	2800	2800	2800
H Ground clearance	mm	410 (20 in. tyres)	446	446
I Turning radius on std tyres	mm	3450	3450	3450
J Overall bodywork width	mm	2235	2235	2235
Weight (unladen)	kg	6963	7605	7800



		K50	K60	K70
Performance				
Max lift height on std tyres	mm	6012	6200	7211
Max lift capacity	kg	3000	4000	3500
Load centre	mm	500	500	500
Capacity at full height	mm	3000	3000	2000
Reach at max load	mm	1473	1300	1755
Height with max capacity	mm	6006	5370	5782
Max forward reach	mm	3003	3144	3937
Max capacity at max reach	kg	1250	1500	1500
Carriage specifications		ITA3B	ITA3B	ITA3B
Break out force	kN	49	52	52
Machine speed (km/hr) for 106 hp				
Forward 1		6.3	6.3	6.3
Forward 2		8.7	8.7	8.7
Forward 3		12	12	12
Forward 4		17	17	17
Forward 5		28	28	28
Forward 6		40	40	40
Reverse 1		6.3	6.3	6.3
Reverse 2		12	12	12
Reverse 3		28	28	28

		K50	K60	K70
Carriage				
Max crowd forward fully lowered - degrees below horizontal		60	60	60
Max crowd back fully lowered - degrees behind vertical		13	13	13
Max crowd forward fully raised - degrees below horizontal		7	7	7
Max crowd backward fully raised - degrees beyond vertical		82	82	82
Total carriage rotation - degrees		163	163	163
Max distance between forks - mm		1200	1200	1200
Cycle time				
Lift	sec	7.7	7.7	7.7
Lower	sec	5.6	5.6	5.6
Extend	sec	4.7	4.8	6.8
Retract	sec	3.4	4.0	5.8
Crowd forward (dump)	sec	2.5	2.5	2.5
Crowd backward	sec	2.4	2.4	2.4

		K50	K60	K70
Engine				
Perkins 1004.40T	kW (PS)	78.5 (106)	78.5 (106)	78.5 (106)
Net output	Nm (rpm)	394 (1400)	394 (1400)	394 (1400)
Perkins 1004.40TW	kW (PS)	91.0 (122)	91.0 (122)	91.0 (122)
Net output	Nm (rpm)	434 (1500)	434 (1500)	434 (1500)
Cooling				
Thermostat - opens	°C	70 - 80	70 - 80	70 - 80
Thermostat - fully open	°C	90 - 95	90 - 95	90 - 95
Transmission		DANA T12000	DANA T12000	DANA T12000
Gear Selector		APC Powershift	APC Powershift	APC Powershift
No of gears	(Fwd/Rev)	6/3 (40 km/h)	6/3 (40 km/h)	6/3 (40 km/h)
No of gears	(Fwd/Rev)	5/3 (25 km/h)	5/3 (25 km/h)	5/3 (25 km/h)
No of gears	(Fwd/Rev)	4/2 (20 km/h)	4/2 (20 km/h)	4/2 (20 km/h)
Gear Selector		Non APC	Non APC	Non APC
No of gears	(Fwd/Rev)	3/3 (25 km/h)	3/3 (25 km/h)	3/3 (25 km/h)
No of gears	(Fwd/Rev)	4/3 (40 km/h)	4/3 (40 km/h)	4/3 (40 km/h)
Tyres				
Cross Ply, Agri		15.5/80-24	15.5/80-24	15.5/80-24
Radial Ply, Agri		445 R 24	445 R 24	445 R 24
Radial Ply, Agri		495 R 24	495 R 24	495 R 24
Radial Ply, Agri		420 R 20	420 R 20	420 R 20
Radial Ply, Ind		455/70R24	455/70R24	455/70R24
Flotation		600 - 26.5	600 - 26.5	600 - 26.5

		K50	K60	K70
Hydraulics				
Pump type		Load sensing	Load sensing	Load sensing
Primary system max. pressure	bar	250	250	250
Primary system max flow (Up to Machines S/No.51200471)	l/min	122 @ 2300 rpm	122 @ 2300 rpm	122 @ 2300 rpm
(From Machines S/No.51200472)	l/min	122 @ 2200 rpm	122 @ 2200 rpm	122 @ 2200 rpm
Primary system (load sensing)	bar	14	14	14
Primary system (standby)	bar	20	20	20
Secondary system max. pressure	bar	160	160	160
Secondary system max flow	l/min	50	50	50
No. of aux. services	option	2 front, 1 rear	2 front, 1 rear	2 front, 1 rear
Electrics				
Battery capacity	Amp/hr	128	128	128
Alternator output	Amp	65	65	65
Capacities				
Hydraulic system	litre	128	128	128
Hydraulic tank	litre	67	67	67
Fuel tank	litre	200	200	200
Engine oil	litre	9	9	9
Engine coolant	litre	31	31	31
Transmission	litre	16	16	16
Transmission transfer box	litre	0.4	0.4	0.4
Axle - front	litre	9.5	9.5	9.5
Axle - rear	litre	10	10	10
Axle - final drive (each)	litre	0.8	0.8	0.8
Screen wash	litre	6.5	6.5	6.5

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A stylized, handwritten signature in black ink, appearing to read 'Paul Dodd'.

Paul Dodd
Field Service Manager

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